FRIDAY, JUNE 29, 1883.

THE IMPORT DUTY ON SCIENTIFIC JOURNALS.

THE failure of Congress last session to put books and periodicals on the free list was, whatever some of our literary friends may think, a serious disappointment to many scientific workers. As to the general free-trade question, or the impolicy of imposing a tax on mental culture, we have nothing to say here; and, indeed, nothing that scientific men could say would at present have any practical effect against the influence which the publishers, with their capital and organization, exert whenever they think their interests threatened. We believe, however, that something might be done by a combined effort of American scientific men to get the duty removed from certain specified foreign journals, which no publisher in the United States would ever dream of reprinting, and which in no way compete with any American publication. To take a few examples: the *Quarterly journal of mathematics*, the *Repertorium der physik*, the *Comptes rendus*, and *Pflüger's Archiv für die gesammte physiologie* could never conceivably be reprinted in this country except at a loss. On each number of these journals, as it arrives by mail, the subscriber is nevertheless forced to pay duty before it is delivered to him, and is frequently put also to the additional annoyance of having to go in person to the post-office or customs-house. These vexatious duties protect no American interest. What they do protect, if any thing, is the European investigator from equal competition on the part of American workers, to whom the gaining of a knowledge of what is taking place in other countries in the various branches of science is made as costly as possible.

It is useless to answer that all incorporated educational institutions get their periodicals duty free. Many of the most active workers have no college library within reach; still fewer colleges can afford to subscribe to more than a very limited number of scientific journals; and all busy teachers and investigators know that it is essential to have at least the chief publications in their own special line of work always at hand for immediate consultation, or for perusal in a chance half-hour's leisure, without the necessity of a pilgrimage to a library for the purpose. Happily, the day is rapidly going by when all expected from a college professor was, that he should be pretty well 'up' in a tolerably modern text-book, and be able to hear recitations from it. To maintain a worthy position among his fellows, and do his duty by his students, a professor nowadays must know something of all the recent work of importance in his own line of study; not necessarily know the details in each minute subdivision of it, but at least have skimmed over the recent publications, so as to be able to tell an inquiring student where the latest papers are to be found, and give him some hint as to the comparative value of the investigations of different workers. To do this properly, a professor must have the readiest access to the current literature of his own department. This 'readiest access' implies that he must receive personally all the more important journals at the earliest possible date.

We venture to suggest to the American association for the advancement of science, that it appoint at its next meeting a committee to draw up a definite list of foreign technical journals of mathematics, physics, chemistry, mineralogy, geology, geography, botany, zoölogy, physiology, and ethnology, such as do not compete with any enterprise of any publishing firm in the United states; and then urge upon Congress the passage of a special act, putting these journals on the free list. In England, France, and Germany, there are always to be found members willing to bring before the legislature the legitimate claims of science. We cannot doubt, that, if a suitable bill were drawn up by official representatives of science in the United States, some member of Congress could be found to introduce and support it. If judiciously framed, so as to touch no publisher's pocket, and vigorously

supported by the influence of the scientific men of the country, such a bill could, we feel certain, be passed through Congress, liberating us from this tax, which falls heavier on men the poorer they are and the more faithfully they try to do their duty.

Some of our most esteemed literary idols have lately astonished us by signing a statement which seems to imply, that, in their opinion, American literature needs coddling to keep it alive. They must decide in their own line of work. We are certainly not less proud of, or less desirous to cherish, American science than they are American letters, and, we are bold enough to think, with at least as much reason. We are sure that we give expression to the conviction of all American scientific men when we say that we believe in no isolated American science. The accurate study of nature is the common duty of all civilized peoples: what each does helps all the rest.

In this connection, we are rejoiced to find that most American artists have taken a position in regard to art agreeing with ours in regard to science. The attitude lately taken by certain prominent authors is but one sign, among several, of a certain tendency in Literature to fall from its former lofty ideals; and, losing the characteristics of a profession, to become simply a trade, followed for the sole sake of the money to be made at it. If this does happen, then Art and Science will have to take the place once held by Letters, and strive to keep alive the belief that there are more worthy aims in life than getting the largest possible number of dollars for one's work, whatever it be. We do not, however, now ask our literary friends to expose themselves to a promiscuous, and, as they appear to think, debasing competition: we only ask to be allowed, duty free, a limited number of purely technical journals; and we shall still read with delight the *Autocrat* and the *Professor*, although sorely pained that our own familiar friend, in whom we trusted, has done what lay in his power to make it difficult for us to learn our anatomy.

THE MICROSCOPIC EVIDENCE OF A LOST CONTINENT.

Much interest has been attached to St. Paul's rocks, situated in the mid-Atlantic nearly under the equator; since they were stated by Darwin[1] to be unlike any rock he had ever met, and that they were not volcanic. Darwin's words have caused these rocks to be looked upon as forming a portion of the lost Atlantis; those holding that view overlooking the fact that Darwin simply meant that they were not rocks of volcanic origin such as those he had any acquaintance with. That they were not eruptive or volcanic of earlier date than the other islands in the Atlantic, he was not in a position to assert, and evidently did not intend to do so. Being of different material from the other Atlantic islands, they might even be of comparatively modern origin, and still not show especial traces of their eruptive character. Situated as these islands are, no relation of the rocks of which they are composed to the adjacent rocks can be ascertained: hence the only resort is to study the structure and composition of the rock-mass itself, and to ascertain what evidence it may afford.

When these rocks were examined *in situ* by the members of the Challenger expedition, they were thought by Mr. Buchanan to be referable to the serpentine group, but by Prof. Wyville Thomson to have been formed by the 'ejecta of sea-fowl.'[2]

In this state of affairs, the material collected was wisely placed by Mr. John Murray, who had charge of the Challenger material, in the hands of a competent lithologist, Rev. A. Renard, S.J., curator of the royal museum of natural history at Brussels.

When studied microscopically these rocks were found to be composed of olivine, enstatite, actinolite, chromite, or picotite, and a pyroxene mineral. When M. Renard first examined these rocks, he thought that he discovered in them certain structures which he regarded as fluidal.[3] He therefore held that these rocks were of eruptive origin; but in some publications recently issued he has modified his views, and is inclined to regard the structures seen as schistose and not fluidal.[4]

M. Renard then endeavors to show that these may be metamorphic sedimentary rocks

[1] Volcanic islands, 1851, pp. 31-33, 125.
[2] Voyage of the Challenger, ii. 100-108.
[3] Neues Jahrb. min., 1879, 389-394.
[4] Description lithologique des récifs de St. Paul (Ann. soc. belge micr., 1882, 53 pp.); Report on the petrology of the rocks of St. Paul (Scient. results voyage Challenger, 1873-76, Narrative, 1882, ii. app. B, 29 pp., 1 plate).

and therefore, according to him, true schists; hence he would argue they are the remains of an extensive land area — an Atlantis — of which, owing to denudation, only these few remains are left. His arguments are based on the apparent microscopic schistose structure of the St. Paul's rock, and on the fact that certain olivine rocks have been found associated with crystalline schists.

In examining the first evidence, the writer may state, that he has in his possession two specimens of these rocks, sent him by Mr. John Murray; and therefore the evidence that their sections afford will be given. The sections of one — the least altered — are composed of olivine, enstatite, diallage, picotite or chromite, magnetite, pyrite, actinolite, and serpentine.

While M. Renard remarks that all the minerals have their principal axis parallel with the supposed schistose or fluidal structure, they are found by me to stand in every direction regarding that structure, — even at right angles to one another. Indeed, no structure has been seen by me that I can regard as truly schistose or fluidal.

A structure does exist somewhat resembling a schistose one, which appears to be the result of secondary alteration of the rock-mass. M. Renard states that the rock is fresh and unaltered in certain of the specimens, and one of mine answers to his description of his supposed unaltered rock. He further states, that the structure of this rock is peculiar, and unlike that of other olivine rocks. My sections lead me to a somewhat different conclusion. In them, portions were found that I regard as the original, unaltered rock. These showed the same structure and characters that other unaltered olivine rocks show, and do not appear to be of any abnormal type.

The main portion of the rock which M. Renard regarded as groundmass, and held to be unchanged, is, in my opinion, greatly altered, and contains only remnants of the original minerals of the rock. He regards this groundmass as composed entirely of olivine grains, but of this I have grave doubts. The microscopic characters of this groundmass do not appear to me to be those of ordinary olivine, but rather those of minerals of secondary origin. That this groundmass is of secondary origin, for the most part, is shown by its occurrence along the fissures in the unaltered olivine; by its relations to the minerals that it surrounds, — which relations are the same as those existing between the original minerals and their alteration products in other rocks; and by the so-called schistose structure. I do not design to call in question the work of M. Renard, who is a thoroughly competent observer, and whose sections have not been seen, but rather to show that the characters in my sections do not, in my judgment, bear out the conclusion derived by him from his. Questions of this kind are largely dependent upon the methods of work and the kind of study to which the observer has devoted himself. M. Renard has given much time to the study of crystalline schists and the older eruptive rocks; while the present writer has, for a number of years, devoted much of his time to the study of unaltered rocks, and to the tracing of their various types through to the extreme phases of alteration, studying both modern and ancient forms, with especial reference to their origin and development. It is therefore natural that we should both look at the St. Paul's rocks from a somewhat different stand-point.

But to continue. It is contrary to the laws of physics and chemistry, that a mineral in the process of alteration should produce itself again. Alteration is rather a passage from an unstable to a more stable compound in the conditions to which the rock is then exposed: hence the resulting mineral in this case must belong either to another variety of olivine, or to a distinct mineral species. This would hold good if more than one mineral should be formed.

The actinolite, picotite or chromite, magnetite, pyrite, and serpentine, are regarded by me as secondary products in this case, and not original minerals.

In the places showing the unaltered condition of the rock, the granular structure is the same as that believed to be due to crystallization from an igneous magma, and not owing to detrital action.

The specimens sent me show that they are surface and weathered specimens, to which cause is probably due much of the difficulty met in their study. It is to be hoped, that, should St. Paul rocks be visited again, great pains will be taken to procure specimens as far in the solid rock as possible.

Microscopically, then, the writer holds that these rocks afford evidence in their structure and composition favoring the view that they are eruptive, while in his sections he can find nothing supporting the theory of M. Renard.

It now remains to look at the question of the association of olivine rocks with schists as proving that they are both of a common origin.

This line of argument the writer had occa-

sion to meet in reference to rocks of a different composition a few years ago.[1] M. Renard's line of argument would prove that a dike in conglomerate had the same origin as the conglomerate itself, — would prove, that, when sandstones and lava-flows are interbedded, both have a common origin. In any volcanic district we have mingled in inextricable confusion lava-flows, ashes, scoriae, dikes, and sedimentary rocks: are these all of common origin because they are associated? Is a lava-flow, buried by the seashore sands, of like origin with the sand? In our older rocks we have dikes cutting in every direction: are they the same as the rocks they cut?

The only proof regarding the origin of associated rocks is the relation that they bear to one another: the mere fact of association in itself is no proof.

In another respect M. Renard's argument is faulty, inasmuch as it assumes that all crystalline schists are of sedimentary origin. Eruptive are, as a rule, more subject to alteration than sedimentary rocks; therefore, in proportion to their abundance, they are more commonly found as metamorphic rocks than the others. One of the common metamorphosed characters of eruptive rocks is a schistose structure, and the mere fact that a rock shows such a structure affords no proof of its origin. The writer has seen a well-marked schist cutting in a dike directly across the stratification of a conglomerate, — it was, of course, a metamorphosed basic, eruptive rock, — and he has seen numerous other examples of a similar character.

The best evidence regarding the origin of the olivine rocks is in behalf of their eruptive characters, as M. Renard points out: on the other side, positive evidence seems to be wanting, it being rather a matter of personal opinion than facts. In such cases as those examined by Professor Bonney, and the one studied by the present writer on Lake Superior, the facts and evidence in behalf of their eruptive origin are clear and explicit. So far, then, as the mineralogical constitution of the St. Paul's rocks go, it points rather towards an eruptive than a sedimentary origin for them.

Indeed, did it not, it is difficult to see how any denudation could take place so far down in the sea, as is here required, when, as M. Renard admits, there is no evidence that any sinking has occurred.[2]

The writer would therefore hold that the St. Paul's rocks offer no evidence in favor of their being the remains of a lost Atlantis; but rather that they are of eruptive origin, like the other Atlantic islands, although probably of earlier date than the prevailing rocks upon the latter.

M. E. Wadsworth.

[1] Proc. Bost. soc. nat. hist., 1880, xx. 470-479.
[2] See also Prof. A. Geikie, *Nature*, 1882, xxvii. 25, 26.

THE PASCAL HEXAGRAM.

The Royal academy of Belgium in 1879, and again in 1881, offered its prize for a solution of the following question: "To extend as much as possible the theories of the points and lines of Steiner, Kirkman, Cayley, Salmon, Hesse, Bauer, to the properties which are, for higher plane curves and for surfaces and curves in space, the analogues of the theorems of Pascal and Brianchon (see, for these last, the writings of MM. Cremona, P. Serret, and Folie)." The only contestant for the prize in 1881 was Professor Veronese of the university of Padua, whose work on the subject of the original theorems was already well known. To the paper submitted by him, the Belgian academy, advised by its committee, consisting of MM. Folie, Catalan, and de Tilly, declined to award the prize; and the paper has, in consequence, been published in full in the *Annali di matematica* (xi., Dec., 1882, 143 p.) with the report of M. Folie, and a commentary thereon by Veronese. It is a controversy of unusual liveliness for a mathematical one. Before entering upon its merits, we shall give a summary of the memoir of Professor Veronese.

The extensions of the properties of the Pascal hexagram hitherto proposed have been special, and not general, and hence are incapable of being carried farther. When, for instance, the six perfectly arbitrary points on the conic are replaced by six generatrices of the hyperboloid, three must be taken from one system, and three from the other; and one gets, with this restriction, only a single pair of lines, corresponding to one conjugate pair of the twenty Steiner points. Cremona's extension to a cubic in space, on the other hand, can be obtained by simple projection from the hexagram in a plane conic. To develop these special, uninteresting, easy results would not be, according to Veronese, to answer the proposed question; so, leaving them one side, he proceeds to the application of a different method, — the theory of substitutions. His method is, in brief, to represent the six points on a conic by six values of a parameter, whose permutations give, from any figure whatever which they represent, seven hundred and twenty figures of the same kind, or a divisor of 720. If, for

instance, the parameters are the homogeneous co-ordinates of a point in a five-dimensional flat, one gets, by permuting them, seven hundred and twenty points, which correspond in twelves to the sixty Pascal lines. The analogy is precise; for the two figures have the same algebraic base, namely, the substitutions. In his former paper, Veronese forms, for convenience, out of the six fundamental points, fifteen triangles, and, out of the sixty Pascal lines and Kirkman points, six configurations Π, consisting each of ten Pascal lines and ten Kirkman points, poles and polars with respect to a conic. He finds, that, in a five-fold flat, to the triangles correspond fifteen surfaces of the second order in four dimensions; to the sixty Pascal lines, sixty surfaces of the fourth order in three dimensions; to the twenty Steiner points, twenty surfaces of the sixth order in two dimensions; and, to the six figures Π, six configurations Π, represented in the theory of groups by the six remarkable six-valued functions found by Serret (*Liouville*, 1850). As a sample of the vast multitude of propositions given concerning these figures and spaces, we may take the following: the seven hundred and twenty points obtained by permuting the six co-ordinates form a hundred and twenty cycles of six points on rational curves of the fifth order. They lie in sixes on conics in twenty-four hundred planes, which pass by hundred and twenties through the twenty intersections of the space unity with the faces of the fundamental pyramid. They are in twenty-fours in four hundred and fifty threefold spaces, which go by thirties through the intersections of the space unity with the fifteen threefold faces of the fundamental pyramid; and in hundred and twenties on thirty-six fourfold spaces, which go by sixes through the intersections of the space unity with the six fourfold faces of the fundamental pyramid. Such properties as these are simple and interesting in space of high degrees; but it is well to utilize them also for space of two and three dimensions, which Veronese does by means of his method of projection (*Math. ann.*, xix.). Thus for every complete tetrahedron, pentagon, and hexagon, in space of three dimensions, he gets configurations of points, lines, and curves, like those of the Pascal hexagram, and so for every triangle, quadrilateral, pentagon, and hexagon of the plane; and he remarks that the same method might be applied to configurations determined by any value of n in a space of $n - 1$ or less dimensions. Another geometrical interpretation of the groups of substitutions of six letters is given by six linear complexes of lines in involution two and two (*Klein, math. ann.*, ii.). They determine fifteen surfaces of the second order, whose intersections are sixty curves of the fourth order corresponding to the sixty Pascal lines. There is also a theorem analogous to the Pascal theorem for a rational quartic in fourfold space.

M. Folie, in his report on this paper, complains that the contestant has refused to understand the question in the plain sense in which it was proposed; that he should have started out from the propositions which in M. Folie's book, 'Sur les fondements d'une géométrie supérieure Cartésienne,' are said to be analogous to the Pascal properties, namely, that in a plane cubic curve opposite sides of two quadrilaterals cut in a line, and that in a cubic surface opposite faces of two tetrahedrons cut in four lines in a plane; that, after having extended the question as far as possible in this direction, it was open to him to take another point of view, and even that which he has taken, though that is perhaps least of all susceptible of generalization. This work, he says, is remarkable and highly original, and would have deserved the prize had it been the aim of the academy simply to call forth a work of that description; but its object was to engage young geometers in the way already opened in his own memoirs, and to provoke them to researches which should complete those of the Belgian school of geometers, according to the expression of M. Chasles. This the author has not done: the question, hence, remains unattacked, and will continue to be retained upon the programme of the academy. Veronese, in reply, very pertinently inquires why it was not equally incumbent upon the contestant to follow in the way marked out by the Italian and the French schools, by Cremona and by Serret, and maintains that the prize is wrongly withheld on account of his having followed a new and original way instead of that which M. Folie professes to have pointed out to the geometers of the future. He admits that his results are not very susceptible of generalization, for the reason that they are already so extremely general. He complains that M. Folie has given no idea of the contents of his paper, — the usual task of a *rapporteur*, — and that, in each instance in which he refers to it, he fails to understand it. M. Folie says, for example, that Veronese has applied his method to cubics in space because he could, but not to plane curves or surfaces of order higher than the second, because his method was not there applicable; while, in fact, Veronese obtains

his results for curves in space not at all by application of his method, but by simple projection from the Pascal hexagram. M. Folie objects to Veronese's using the term 'involution' instead of 'cyclic homography;' but an examination of the table of contents might have shown him that Veronese devotes a section of his paper to cyclic homographies, and he gives simply a natural extension to the ordinary meaning of the term 'involution.' But, worst of all, M. Folie makes a singular slip in the enunciation of the original question, for there are no points or lines in the figure which are known as the points or lines of either Hesse or Bauer. At the end, Veronese turns the tables upon his opponent, and points out several striking inconsistencies in his memoirs, and several instances of his peculiar 'art of phrasing:' as, "The greater part of these [M. Folie's] theorems had not yet been discovered, in spite of the depth and penetration of geometers;" "To deduce the corollaries from them would be an enterprise which would require, perhaps, years of labor;" "It is a field which I have cleared, and in which those who follow will find an ample harvest of discoveries."

In conclusion, we can but share the regret expressed by the direction of the *Annali*, that academies should so frequently provide unwisely for the advancement of science, either by proposing subjects which are too special, or by compelling authors to follow in their solution a direction determined *a priori*.

Christine Ladd Franklin.

OCCURRENCE OF AMBER NEAR TRENTON, N.J.

At the April meeting of the Trenton natural history society, the occurrence of amber in the bed of Crosswicks Creek was referred to, and no one of those present reported success in searching for it. The authority for its occurrence rests wholly, I believe, upon the statement in Comstock's Mineralogy (Boston, 1827), that it occurs 'near Trenton, N.J.,' and, again, "that found near Trenton occurs in small grains, and rests on lignite, or carbonated wood, or even penetrates it" (p. 297). I have several times met with small grains or pebbles of the mineral in the bed of Crosswicks Creek, and in 1860 found a mass as large as a pea, which I gave to the late W. S. Vaux, Esq., of Philadelphia. These small grains of amber, found in the bed of the creek, are undoubtedly derived from the beds of clay which are exposed in the bluff forming the southern bank of the creek. Clays of the same character and age (cretaceous) occur nearer Trenton than Crosswicks Creek; and in them, also, occurs much fossil wood. In and on this, grains of amber are not uncommon. They are usually very small, and difficult to detect. The fossil wood in this cretaceous clay is soft and very 'recent' in appearance, and burns with an uncertain, flickering flame. The scanty traces of amber found with this — derived, I suppose, from it — is the fossilized sap of the trees now found in these deposits of clay.

Charles C. Abbott.

THE TOTAL SOLAR ECLIPSE OF MAY 6.

The U. S. S. Hartford, which sailed from Callao, Peru, March 22, with the American and English astronomers on board, arrived at Caroline Island April 20, sixteen days before the date of the eclipse. The island is in reality a chain of small islands of coral formation, encircling a lagoon; the length of the enclosure being about seven miles and a half, and the breadth one mile and a half. The land is low, but supports an excellent growth of grass and other vegetation, including a number of cocoanut-trees. There are no permanent inhabitants; but the island is leased by an English firm which deals in guano, cocoanuts, and other products of this and similar Pacific islands. An agent of this firm visits the island occasionally, and superintends the work of those employed. Seven persons were found living on the island for the time being, having been brought there from Tahiti two months before. These were four men, one woman, and two children. There were two large frame houses in excellent condition, besides several smaller houses, which furnished comfortable accommodations for the party, and also for the French astronomers, who arrived two days later in the L'Eclaireur. The latter party was composed of the following scientific men: M. Janssen of Meudon; M. Tacchini of Rome; M. Palisa of Vienna, formerly of Pola; M. Trouvelot of Meudon, formerly of Cambridge, Mass.; and M. Pasteur, photographer, also of Meudon.

The landing of the heavy cases containing the instruments was accomplished with difficulty, as even the small ship's boats could not come within several hundred feet of the shore, which was composed of rough coral rock. The cases were taken from the boats by men standing in about two feet of water, and carried to the shore, thence across several hundred feet of coral rock to the land, and about a quarter of a mile farther to the site selected for the ob-

servations. After the completion of the landing, the men-of-war steamed away to Tahiti, leaving selected members of their companies to assist in the work. The American party was favored with the help of Messrs. Qualtrough, Dixon, Fletcher, and Doyle, officers of the Hartford, and of ten seamen.

The two weeks preceding the eclipse were occupied in mounting the instruments and in other preparations. Pendulum observations during this time were made by Messrs. Preston and Brown, under instructions from the U. S. coast and geodetic survey. The weather was in general pleasant; though there was one severe rain-storm, and nearly every day there were flying clouds with slight showers, as is not unusual in the region of the trade-winds. The wind was usually strong, and blew steadily from a direction varying from north to east, but never south of east, though the island is in the heart of the south-east trade region. Eight inches of rain fell during the seventeen days which the party spent on the island, more than half of this in one storm on May 4.

The weather on the morning of May 6 was cloudy and threatening; but after several showers the sky cleared shortly before the time of first contact, and remained clear the remainder of the day, with rapidly moving clouds. One of these partially concealed the corona for about twenty seconds in the first minute of totality, and the sun was wholly in a cloud soon after the close of totality; but the observations were not interfered with, though there was at all times haze in the atmosphere. Your readers have already been informed of the nature of the observations planned. All these were carried out successfully, with results which will be given in full detail in the official report of the expedition. A summary of these results can, however, be given at the present time. Professor Holden swept for intra-Mercurial planets, but discovered none. Spectroscopic observations were made by Dr. Hastings and Messrs. Rockwell, Brown, and Upton, with interesting results. Dr. Hastings had devised a spectroscope by which the spectra of two opposite sides of the sun were brought into juxtaposition, and could be examined simultaneously. This instrument, which was attached to a 6¼-inch equatorial, was used especially to note the changes in the appearance of the 1474 line on the preceding and following limbs of the sun as the eclipse progressed. At the beginning of totality the 1474 line extended to a height of about 12′ on the eastern limb of the sun, while on the western limb it was faint, and not more than 4′ in height. As the eclipse progressed, the lines changed relatively, becoming sensibly equal at mid-eclipse, and the conditions at the close of totality being the reverse of those at the beginning. This change was many times greater than any change due to the moon's motion, and is regarded by Dr. Hastings as conclusive proof that the outer corona is mainly due to diffraction. The dark D lines were seen in the corona, and the bright hydrogen and magnesium lines by several observers. The relative height and brightness of the coronal rings seen in an integrating spectroscope were estimated.

The duration of totality was five minutes twenty-five seconds. The corona was bright, and characterized by five well-defined streamers, a careful sketch of which was made by Dr. Dixon. The azimuths of the shadow-fringes at the beginning and end of totality were obtained, and their distances from each other estimated. The meteorological observations made by Mr. Upton showed a slight but well-defined rise in barometric pressure, a rise in humidity, and a fall in temperature. The temperature reached the values given at night, while the radiation thermometers indicated that the receipt of heat by the earth was almost wholly checked. The direction and velocity of the wind were unchanged during the time of the eclipse.

The photographs obtained by Messrs. Lawrance and Woods, the English members of the party, who were assisted by Mr. Qualtrough of the Hartford, include a series of negatives of the corona to its outer limits, and also of the coronal spectrum. The latter contains a few bright lines, but not as many as were obtained by the same observers in Egypt a year ago. The phenomenon of reversal of the Frauenhofer lines was also successfully photographed.

The French astronomers obtained many photographic negatives of the corona, and of the sky in the vicinity of the sun, to aid in the search for Vulcan. M. Palisa searched for intra-Mercurial planets without success. M. Janssen saw dark lines in the coronal spectrum, and M. Tacchini a faint spectrum resembling that of comets in one of the coronal streamers. M. Trouvelot made a sketch of the corona, and devoted also a portion of the time to the search for intra-Mercurial planets.

The Hartford returned to Caroline Island on the 8th of May, and on the 9th sailed for Honolulu, which was reached on the 30th; a stop of four days having been made at Hilo, Hawaii, to allow a visit to the volcano of

Kilauea. The members of the expedition, except Messrs. Preston and Brown, who remained at the Hawaiian Islands to make pendulum observations, left Honolulu by the steamer Zealandia on the 4th of June, and arrived at San Francisco June 11. W. U.

technical society a piece of apparatus, shown in the illustration, which, when connected in circuit with a telegraph-line, will show the varying strength of the current in the line, registering the results on a diagram. The earth-currents are generally very weak, and only can be

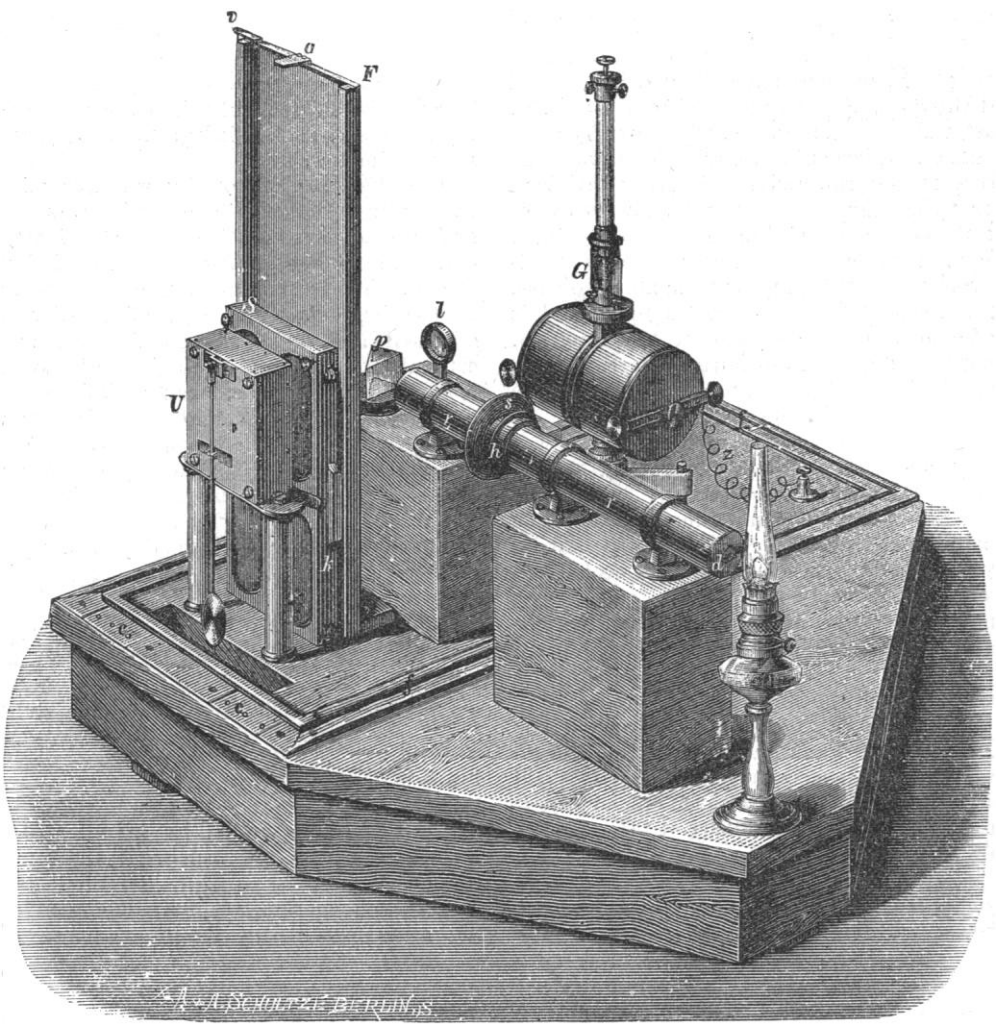

Fig. 1.

REGISTERING APPARATUS FOR EARTH-CURRENTS.[1]

For the purpose of studying the earth-currents on telegraph-lines, the instrument-maker, Wauschaff of Berlin, has made for the earth-current committee of the German electro-

shown by the most delicate galvanometers, so that no registering apparatus requiring a great amount of force could be used. This necessitated the use of photography. That the observations might be independent of the hour of the day, an artificial source of light was used. The most sensitive dry plates were employed, and, to keep out all extraneous light, the

[1] From the April number of *Zeitschrift für instrumentenkunde.*

whole apparatus is covered with a wooden box, removed in the illustration. This cover turns on the hinges at *c*, and, when closed, rests in the grooves *f*. The tubes *r* and *r'* are furnished with two cloth-lined metal collars, which can be pressed up against the box where the tubes pass through it. The outer end of *r* is closed with a plate in which there are three round holes side by side in a horizontal line. Before this plate is the diaphragm *d*, which can be turned on a vertical axis, and through which there is one hole. With this diaphragm the central opening in the end of *r* may be alone left open. In front is placed a kerosene lamp. From the flame of this lamp a fine pencil of rays passes through the hole in *d*, along the tubes *r* and *r'*, and is reflected by a total reflecting-prism, *p*, which throws it on the mirror, *G*, of the galvanometer, which is connected in circuit with the line by the wires *z*. From the mirror *G* the light is reflected back through the lens *l*, which brings the rays to a focus on the photographic plate. This plate is put in a holder, *k*, in the slide *S*, before the beginning of the observation. There are spring clamps on *S*, so that, when the cover is drawn from in front of the plate, the holder will remain in *S*. In order that it may be possible to expose the plate after the box-cover is put down, there is a slit covered with rubber cloth in the box, through which the fingers may reach the top of the plate-holder and pull out the sliding front. The slide *S* travels on guides *F*, and on one side is furnished with two rollers, and on the other with one; so that the movement may be as straight as the guide against which the two rollers press. In the front side of *F* there is a horizontal slit at the height of the focus of the rays. The back side of *S* carries a rack which fits a pinion on the driving-axis of the clock *U*. The downward movement of *S* is therefore regulated by this clock, of which it forms the driving-weight. The downward velocity is about 80 mm. per hour. This is sufficient to allow of changes from minute to minute being easily distinguished. For the purpose of allowing different rates of speed, it is proposed to put another rack on the back of *S*, which, by a sliding motion, may be made to catch on a second pinion of different size.

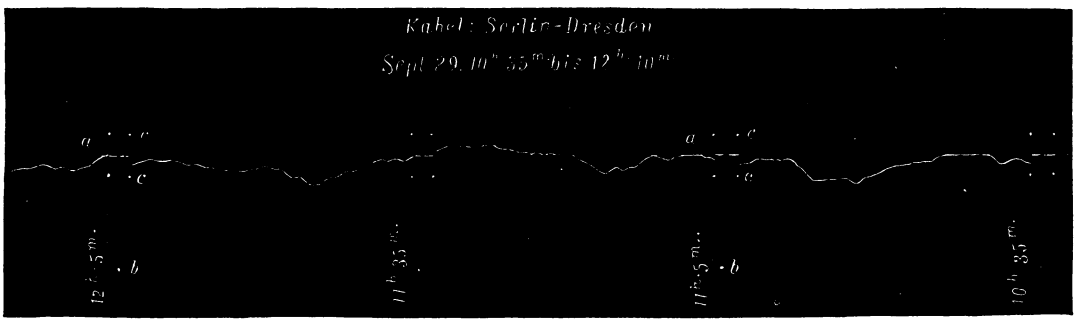

FIG. 2.

For lesser changes the pendulum may be varied in length.

The wires leading to the galvanometer are connected with a commutator. When the needle is in its position of rest, a straight line will be marked on the plate by an upward movement of the slide. From this line the deflections caused when the earth-currents pass are measured. Time-signals may be made by turning back the diaphragm *d*, when marks will be made on each side of the neutral line. From time to time, currents of known strength may be sent through the apparatus, and will produce spots, as *b*.

Fig. 2 shows one of the diagrams obtained. The abscissa line was drawn through the portions *a*, which were marked by the light. The portions *a* are broken, and at these points occur the dots *b*, the result of the known currents. *c*, *c* are the time-signals.

A NEW CONDENSING-HYGROMETER.

EVERY one who has had occasion to use the common form of condensing-hygrometer for the determination of the dew-point of the air, as devised by Regnault, has found great difficulty in obtaining satisfactory results, especially if the air is in rapid motion, and there is a great difference between the dew-point and the air-temperature.

Professor Crova of Montpellier, France, recognizing these defects, has devised a new form of this apparatus which obviates many of the difficulties, and goes far toward making this justly important instrument one of precision.

The principle adopted is that of condensing moisture upon the *inside* of a polished cylinder the outside of which has been cooled. This instrument described in the *Journal de physique*, April, 1883, consists essentially of a brass cylinder, nickel plated, and highly polished on the inside, provided with two fine tubes near its ends. Through one of these, by means of a rubber tube conducted to the exterior air or to any point at which it is desired to obtain the hygrometric state, the air is drawn into the polished cylinder by using an aspirating-bulb attached to the other. At the first extremity is placed a ground-glass plate, which permits light to enter. This light appears as a bright annulus enlarged three times, as viewed by a magnifier at the other end.

The cylinder is supported in a box, through the centre of which it passes horizontally. This box is provided with two openings, as in an ordinary condensing-hygrometer, through which, by aspiration or by blowing, ether contained in the box may be evaporated, thus lowering the temperature, which is indicated by a properly adjusted thermometer.

In observing, air is drawn into the cylinder by an aspirating-bulb, and at the same time the ether is evaporated. The moment dew appears on the inside of the cylinder, which is easily seen, the reading of the thermometer gives the dew-point. This may be readily obtained again and again with an error less than 0.1° C., or 0.18° F.

Some of the advantages claimed, are the possibility of guarding against varying air-currents; the delicacy of adjustment; the ease and accuracy of observation with the magnifier; the easy manipulation of a uniform light, so difficult to obtain in the ordinary form; and the use of the apparatus in the house for determining the dew-point of the outer air.

In regard to the last advantage claimed, it may be said, that if accurate results can thus be obtained when the air-temperature is from — 40° to — 60°, or when there is a difference of forty or more degrees between the air-temperature and the dew-point, the instrument will be of great service; but there should be some means of aspirating the outside air through the ether, and the apparatus should be very carefully isolated by non-conductors of heat, as the heat of the room would make a sufficient cooling impossible under the conditions just named. The possibility of easily securing such isolation without interfering with the working of the apparatus seems the most important advantage to be derived from its use.

H. A. Hazen.

THE RIGHT WHALE OF THE NORTH ATLANTIC.

The four plates devoted in Dr. Holder's recent paper on this subject[1] to the external and osteological characters of the right whale of the North Atlantic (Balaena cisarctica Cope = B. biscayensis of European cetologists), and the seventeen pages of text descriptive of the same, form a welcome and valuable contribution to the history of a species possessing peculiar interest. Its habitat being the temperate waters of the North Atlantic, — extending from the coast of Florida and the Bay of Biscay, northward to southern Labrador and Iceland, — it was pursued off the coast of Europe for centuries before the Greenland whale (B. mysticetus), the basis of the great northern whaling industry of modern times, became known to Europeans. It was hunted by the Basques and Norwegians as early as the ninth and tenth centuries, was the basis of the whale-fishery of the fifteenth and sixteenth centuries, and was already approaching extinction in European waters, when the great arctic or Greenland whale first attracted the attention of whalers, early in the seventeenth century. The latter, from its greater size, easier capture, and larger numbers, its greater yield of oil and superior quality of baleen, became at once the chief object of pursuit; and the earlier known species was quickly lost sight of as a commercial animal, except on this side of the Atlantic. Here it was the species chiefly hunted by American whalemen down to about the middle of the last century, when from its rarity its pursuit was gradually abandoned for that of the arctic species. The cisarctic animal was early known to the French as the 'sarde;' to the Norwegians, Dutch, and Germans, as the 'nordkaper;' and to the Icelanders as the 'sletbag.' To Americans it was known under the various names of 'northcaper,' 'Grand Bay whale' (in reference to the Bay or Gulf of St. Lawrence, where it was chiefly hunted), 'seven-foot-bone whale,' and 'black whale.' Under these names it was briefly described by various early non-scientific writers, and, in the works of the early systematists, was very inadequately characterized under various systematic names. It is the Balaena glacialis of Klein (1741) and Bonnaterre (1789), the B. islandica of Brisson (1756), and the B. nordcaper of Lacépède (1804). It was, however, practically unknown to science, till the researches of Eschricht and Reinhardt, published in 1861, led to its rediscovery, having been, until then, generally confounded with the B. mysticetus. During recent years it has several times been taken off the coast of southern Europe and in the Mediterranean. These specimens have formed the basis of important memoirs, and given rise to additional specific names. It is, however, now commonly known in Europe as Balaena biscayensis, the name originating really with Gray, although almost universally ascribed to Eschricht, who merely designated the species by an equivalent vernacular name. It was redescribed by Cope in 1865 as B. cisarctica, from a specimen taken at Philadelphia, the skeleton of which is now in the museum of the Philadelphia academy of natural sciences. Ruling out the name 'islandica' of Brisson, on the ground that it antedates the binomial system, and 'glacialis' of Bonnaterre as untenable from its misleading tenor, we have left, of the earlier names, 'nordcaper' of Lacépède, which is objectionable only from its barbarous character, but no more so than hundreds of other names currently employed in zoölogy, save by a few purists who admit nothing that is unclassical.

Dr. Holder describes and figures, 1°. The external characters of a male specimen taken off the New-Jersey coast in the spring of 1882; 2°. The skeleton of a specimen (sex unknown) stranded some years since on Long Island; 3°. Through notes furnished by Dr. G. E. Manigault, a specimen captured in the harbor of Charleston, S.C., in January, 1880. Professor Cope's specimen, and two of the three here mentioned, are more or less immature. There is, however, the skeleton of a fully adult example, taken at Provincetown in 1865, in the Museum of comparative zoölogy, of which, as yet, no description has been published. The New-Jersey example not having been preserved, there exist at present four skeletons of this species in American museums. Dr. Holder figures the skull of the Charleston, the external characters of the New-Jersey, and the

[1] *Bull. Amer. mus. nat. hist.*, vol. i. no. 4, pp. 99–137, pl. x.–xiii., May 1, 1883.

skeleton of the Long-Island specimens, and gives measurements and details of the external characters and osteology, all of the highest importance; our only regret being that he did not, respecting some points, make fuller use of his opportunities. We wish we could speak with equal satisfaction of the historical portion of his paper, comprising one-half of his text. Besides numerous outrageous typographical errors (a part of which, however, are corrected on an *errata* slip), relating to proper names and titles of works ('Researches' and 'Reserches' for 'Recherches,' 'Seibold' for 'Siebold,' 'Van Benedin' for 'Van Beneden,' both the latter in repeated instances, and various others of like character, are among those still uncorrected), there are errors of statement of so grave a character as to require notice. It would seem, for instance, that only the merest novice in cetology could have been misled into supposing that the quotation given at p. 114, respecting a whale captured far up the St. Lawrence River in August, 1871, and reported as 'Balaena mysticetus,' was any thing but a rorqual or finback whale (in all probability, Balaenoptera musculus), much less into an attempt to explain away the evident discrepancies to make it referable to the North Atlantic right whale; yet we find our author devoting several pages to an attempt at this absurdity. Again: in the strictures passed upon Scoresby (pp. 121, 122), he informs us that "his [Scoresby's] inability to portray the subject pictorially was a misfortune," and that "he furnished to science an incorrect figure, at *second hand*," of the B. mysticetus, and considers it 'deplorable' that "nearly every book published to this day, having an illustration of B. mysticetus, shows a manifest copy of Scoresby's figure." That it was the best figure, if not quite correct in all points, of the species down to 1874, when Scammon's admirable illustration was published, has, I think, hitherto been unquestioned; and if our author has evidence that Scoresby's figure (or rather figures, for he gives two) was not original, its presentation would be undoubtedly a revelation to cetologists. That our critic of Scoresby is none too familiar with Scoresby's cetological writings is evident from his statement, that Godman (p. 129) "gives a lengthy account of the mysticetus, with an amount of anatomical and physiological knowledge of the subject quite unusual;" the fact being, that Godman's account is an unaccredited compilation from Scoresby, whole pages being taken entire, and without change, from Scoresby's work, particularly in his notice of the whale-fishery. Bachstrom's figure, published by Lacépède as representing the nordcaper, and which is accepted by Dr. Holder as such, recent eminent authorities have unreservedly referred to B. mysticetus; yet on its interpretation as a representation of the nordcaper rests much of Dr. Holder's criticism of Scoresby. We are surprised to see no reference to the various recent original memoirs relating to the so-called B. biscayensis, either in the author's formal notice of the 'Right whale of Europe' or in the bibliography of the general subject given at the end of the paper. In 'the list of works referred to' the uncorrected errata are numerous; 'J. C. Gray' (four times repeated), for example, standing for 'J. E. Gray,' 'Col. Hamilton' (also on p. 129) for 'W. Jardine,' etc., while there are also inaccuracies of dates. While, as above said, Dr. Holder gives us valuable information about the external appearance and osteology of the North Atlantic right whale, his historical *résumé* is seriously defective and misleading.

J. A. ALLEN.

FIG-INSECTS.

FEW insects offer more remarkable structural peculiarities, or have more puzzled systematists, than the minute Hymenoptera associated with the caprification of figs. Part I. of the transactions of the London entomological society for 1883 opens with a very interesting illustrated paper by Sir Sidney S. Saunders, descriptive of fig-insects allied to Blastophaga from Calcutta, Australia, and Madagascar, with notes on their parasites and on the affinities of their respective races.

It is chiefly as a contribution to the discussion of the affinities of these insects that Mr. Saunders's paper possesses so great an interest. In the transactions for last year, Westwood, by certain authoritative statements, appeared to settle the place of the fig-insects (at least, for the genus Sycophaga) as among the Chalcididae, and not far from Callimome. He remarks, "The structure of these fig-insects, especially as shown in the females (whose character must be shown as more truly normal than that of the males), recedes so entirely from that of the Cynipidae that we cannot for a moment adopt the suggestion that the fig-insects are Cynipidae. . . . Hence M. Coquerel had no hesitation, in describing the female of one of his fig-insects, to give it the name of Chalcis? explorator; and it is impossible to compare his figure of that insect, or mine of Sycophaga crassipes, with a female Callimome, and not be convinced that the fig species are most closely related to Callimome (many of the species of which are parasitic upon the gall-making Cynipidae). The structure of the antennae (even to the minute articulations following the second joint), the fusion of the three terminal joints of these organs, the structure of the wings and wing-veins, and the long exserted ovipositor, sufficiently prove that these insects must be placed in the great family Chalcididae."

Mr. Saunders differs from Westwood in these conclusions, showing that the place of the whole group must not be considered in so sweeping a manner. He disposes of the relationship of the group to Callimome by the following points: 1. The minute articulations in the antennae of the female Sycophaga do not correspond with any in the same sex of Callimome, nor do they occur in Blastophaga, the antennae of which also differ in other respects from Callimome. 2. The fusion of the three terminal joints, while found in Sycophaga, does not occur with Eupristina nor with Agaon. 3. The wing-veins differ *inter se* among the fig-insects, and Callimome does not coincide with Eupristina in this respect; moreover, the wings are invariably absent in the males of the fig-insects. 4. The ovipositor of fig-insects varies in length, and always maintains an arcuate position. The argument which Westwood brought up in a later paper, of the similarity of the dentate genital claspers of Sycophaga to those of Platymesopus and other Chalcids, Saunders disposes of by saying that this character can have no tribal value, as it is found alike in Sycophaga and several of its parasitic associates; moreover, this character is not present in Callimome.

Mr. Saunders's final conclusion is, that this anomalous group which he calls Sycophagides should be placed under the Cynipidae in the following manner: —

1. *Prionastomata.* — Blastophaga Grav., Agaon Dalm., Sycocrypta Coquerel, Eupristina S. Saund., Pleistodonta S. Saund., Kradibia S. Saund.

2. *Aploastomata.* — Sycophaga Westw., Apocrypta Coq.

C. V. RILEY.

OPTICAL RESEARCHES ON GARNET.

It has been for a long time known that all garnets, as well as some other isometric minerals (boracite, analcite, alum, senarmontite, etc.), do not show the action on polarized light which would be required by substances crystallizing in the isometric system; and to find out the causes of these optical variations, and the laws which govern them, C. Klein has examined (*Jahrb. min.*, 1883, 87) as many as three hundred and sixty different garnet sections, cut parallel to different crystallographic planes, and from various localities. His researches do not indicate that because garnets frequently show these optical variations we should refer them to some system of crystallography other than the isometric; for garnets from the same locality often show a great variation in optical properties, some crystals being isotrope throughout, others in part uniaxial or biaxial. Others, on the other hand, have tried to explain the optical variations by regarding the various isometric forms as made up of numerous prisms, either uniaxial or biaxial, united at the centre, and whose bases make up the external crystal faces. Others regard the garnet substance as triclinic, and the various optical properties as the result of repeated microscopic twinning of the same.

The chemical composition does not influence the optical structure of the crystals, because the same optical phenomena are observed in garnets of different composition; and in garnets of the same composition, but with different form, varying optical structures are observed, even among crystals from the same locality. The form, however, in which the various garnets occur, governs the optical structure. Thus, in the octahedral garnets from Elba, what is called the octahedral structure is noticed. A section from this garnet cut parallel to an octahedral face, examined in parallel polarized light with crossed nicols, shows a triangular centre, which remains dark, and three fields on either side, which are alternately dark and light as the section is turned, being dark when one of the sides of the triangle becomes parallel to the plane of either of the nicols. In convergent polarized light, the centre shows the dark cross of a uniaxial crystal, while from each of the three sides a dark bar runs out into the side-fields at right angles to the edge. This indicates a crystalline structure made up of eight uniaxial prisms united at the centre of the crystal, and whose bases form the eight faces of the octahedron. A section cut near the centre of the crystal shows six of these prisms radiating out, while the upper and lower ones have been, of course, cut away. What is called the dodecahedral structure is observed on pure dodecahedrons. A section cut parallel to a dodecahedral face shows, in convergent polarized light, the appearance of two optic axes whose plane lies parallel to the longer diagonal of the rhomb. The tetragonal-trisoctahedral structure observed on crystals of that form shows, in sections parallel to the trisoctahedron faces in convergent polarized light, the appearance of two optic axes with very slight divergence, indicating a crystalline structure made up of twenty-four nearly uniaxial prisms united at the centre, and whose bases are the faces of the trisoctahedron. The plane of the optic axes is normal to the symmetry diagonal of the trisoctahedron face. In the hexoctahedron structure the sections show a biaxial structure, and the plane of the optic axes is very variable. By making and examining artificial gelatine crystals, the author was able to imitate many of the optical variations; and these seemed to be related to a contraction working along the edges of the crystal, and normal to its faces. The greater the contraction along the edges in relation to that normal to the faces, so much greater will be the double refracting power of the crystal. The cause, then, of the optical variations observed in many garnets seems to be tension, caused by unequal contraction, and this being influenced largely by the external elements (edges) of the crystal gives to each form its peculiar optical structure.

S. L. Penfield.

GEOLOGICAL NOMENCLATURE.

The following resolutions concerning nomenclature, coloring, etc., were voted by the recent international geological congress: —

I. Nomenclature.

The elements of the earth's crust are the *mineral masses* (masses minérales).

The mineral masses, regarded from the point of view of their nature, take the name of *rocks*. Considered from the point of view of their origin or mode of formation, they are to be called *formations*.

a. Stratigraphical divisions.

Regarded from the point of view of their age, mineral masses may be subdivided according to the following rules: —

1. The word *group* (groupe) is applied to the three or four great divisions. Ex.: *Secondary group.*

2. The divisions of the groups are designated by the word *system.* Ex.: *Jurassic system.*

3. The divisions of systems of the first grade are designated by the word *series* (série), or by the terms *section* or *abtheilung.* Ex.: *Lower oolitic section or series.*

4. The divisions of systems of the second grade are designated by the word *étage*, or by the corresponding terms, *piano* (Italian), *viso* (Spanish), *stage* (English), *stufe* (German), etc. Ex.: *Étage bajocien.*

5. The divisions of systems of the third grade are designated by the term *assise*, or by its strict equivalents in the different languages. Ex.: *Assise à A. Humphresianus.*

6. The French expression *couches* (beds) may be employed as synonymous with *assise.*

7. A certain number of assises combined will bear the name of *substage* (sous-étage).

8. The first element of stratified masses is the *strate* or *couche, schicht* (German), *stratum* (Latin and English), *strato* (Italian), *retek* (Hungarian).

b. Chronological divisions.

9. The word *era* (ère) is applied to the three or four great divisions of time, corresponding to the groups.

10. The length of time corresponding to a system will be rendered by the word *period* (période).

11. The length of time corresponding to a series (section, série, abtheilung) will be expressed by the word *epoch.*

12. The length of time corresponding to a stage (étage) will be expressed by the word *age.*

II. Colors and signs.

1. Crystalline schists, *rose-carmine* (by preference); *bright rose* for the rocks of pre-Cambrian age; *pale rose* for those of indeterminate age.

2. Primary group. Decision referred to the committee of the map of Europe.

3. Secondary group (mesozoic).
Triasssic system, *violet.*
Jurassic " *blue* (lias, *dark blue*).
Cretaceous " *green.*
4. Tertiary group (cenozoic), *yellow*, using lighter shades as the beds become more recent.
5. Quaternary deposits. Decision referred to the committee of the map of Europe.
6. Resolutions of detail relative to shades, reserves, etchings, and letter notations.

III. Rules concerning the nomenclature of species.

1. The nomenclature adopted is that in which each animal and plant is designated by a generic name and a specific name.
2. Each one of these names is composed of a single Latin or Latinized word, written according to the rules of Latin orthography.
3. Each species may present a certain number of modifications, related to each other in time or in space, and designated respectively under the name of *mutations* or of *varieties.* The modifications whose origin is doubtful are simply called *forms.* The modifications will be indicated, when requisite, by a third term, preceded, according to the case, by the words *variety*, *mutation*, or *form*, or the corresponding abbreviations.
4. The specific name should always be precisely designated by the indication of the name of the author who established it. This author's name is to be placed in parentheses when the primitive generic name is not preserved; and in this case it is useful to add the name of the author who changed the generic name. The same disposition is applicable to varieties elevated to the rank of species.
5. The name attributed to each genus and to each species is that under which it has been primarily designated, provided the characters of the genus and the species have been published and clearly defined.
Priority will not be carried beyond Linné's Systema naturae, 12th edition, 1766.
6. In future, for specific names, priority will be irrevocably acquired only when the species shall have been not only described, but figured.

LETTERS TO THE EDITOR.

A powerful direct vision spectroscope.

AT a journal meeting in which Professor Rowland and the students of physics take part, an article came up for discussion which needs correction. In *Comptes rendus*, April 9, 1883, Ch. V. Zenger, in a note entitled '*Spectroscope à vision direct très puissant*,' claims a dispersive power equal to that of thirteen sulphide-of-carbon prisms of 60° angle for a spectroscope composed of a parallelopiped of two prisms, — one of quartz, and the other of a mixture of ethyl cinnamate and benzine, — combined with a third prism of crown glass of angle of refraction 27° 13′. He gives as the angles the three rays make with the perpendicular to the last prism after they have passed through, —

A	−90° 0′
D	−55° 15′
H	+42° 55′

It will be easily seen that *H* should be negative in place of positive; which will make the dispersion between *A* and *H* 47° 5′, in place of 132° 55′ which the writer gives. H. R. GOODNOW.

Johns Hopkins university.

Connecticut minerals.

The towns of Middletown, Portland, Haddam, and Chatham, in this state, have long been famed as a region remarkable for the number of minerals occurring in the veins of coarse granite. Within the last few days two minerals have been discovered in these veins, which, so far as I am aware, have not previously been reported.

Torbernite has been found at Andrus' Quarry, near the boundary between Portland and Glastenbury, associated with autunite, the occurrence of which has been previously reported.

Rhodonite has been found at the White Rocks in Middletown. WM. NORTH RICE.

Wesleyan university, Middletown, Conn.
June 9, 1883.

Book reviews.

I wish to quarrel a little with the critic of Gage's 'Elements of physics' in your issue of June 8, p. 517, for not keeping the following promise, found in the 'Prospectus of SCIENCE for 1883:' "To promote one of its chief objects, and as a distinctive feature of the journal, SCIENCE will give its hearty support to those who are endeavoring to introduce the study of the natural and physical sciences into public and private schools, by drawing attention in every possible way to the high importance of this measure, as well as by giving illustrated articles, plainly worded, prepared by skilful hands, to guide the efforts of the teachers." He has failed to keep this promise by failing to give such information about the book he reviews as "those who are endeavoring to introduce the study of physical science into public and private schools" would like to have. Many teachers cannot afford to buy every text-book they see advertised, and therefore must needs trust to reviews to tell them enough of a book to enable them to decide whether it is worth purchasing. In regard to a work on physics, they wish some such questions as the following answered: —

1. What is the plan of the book? Does the author expect the pupils to do experimental work, or that the teacher only will perform experiments? 2. If the author wrote with the view of having experiments performed by the pupils, how well has he succeeded in executing his plan? Has he succeeded in giving such experiments as will be of real service in laying the foundation of scientific work, and as can be performed in the short time that teachers in high schools and academies have for such work? Could pupils manage the experiments without the aid of a teacher? 3. Does the author give any directions in regard to preparing apparatus? If so, are these directions sufficiently exact and minute to enable an inexperienced person to follow them without trouble?

All of these questions a teacher would like to find answered in the review of a new book on physics. All the information he would get on these points from the review of Gage's book is found in this sentence: "The book is of merit as giving many experiments with apparatus of easy make." The reviewer said more than this, of course; but this one sentence is all to answer such questions as I have asked above. He was probably right in what he did say, which makes it the more to be regretted that he did not go farther. My quarrel with him is, that he did not say enough; that he did not say as much as your readers had a right to expect, — certainly not enough for those readers who had not seen the book, and wished to know whether it was worth buying. This suggests a question. Are reviews written for the benefit of

those that have made the acquaintance of a book, or for those that have not? For myself, I can answer that I care most for the reviews of those books that I have not seen. In conclusion, I wish to say that Mr. Gage is a stranger to me, and I have never had any sort of communication with him. Whatever one might say in his behalf, my remarks were not made for his benefit, but to point out what I believe to be one of the first duties of the reviewer of a scientific book to his readers. S. T. M.

Lexington, Va., June 13.

[The limited space at our command will not allow of extended analyses of the many text-books of science which are continually appearing. A short notice either of their general merit or demerit is all we can give. In the case of Gage's 'Elements of physics,' the reviewer used the book as a text to preach against the common custom of teachers in using the atomic theory in their explanations as if we knew definitely that atoms exist.]

Solar constant.

Prof. C. A. Young has kindly called my attention to an unintentional oversight in my article entitled 'Solar constant' (SCIENCE, p. 542). In the general equation sent me by him, t represents 'degrees of heat,' not 'quantity of heat;' and m represents 'time,' not 'unit of time.' H. A. HAZEN.

A zoo-philological problem.

On the New-England coast, where Mya arenaria is abundant, and known as the 'clam,' an annelid which is common in the same localities is called the 'he-clam,' and is believed by many fishermen to be the male of the mollusk.

In Norway, Mya arenaria is abundant in the fiords of the north. It has no economic uses; but its associate, an annelid, the 'pür' (said to be Arenicola piscatorum), is an important bait, and gives its name to the Mya which is called the 'pürschaal.'

Why should the common annelid and the common mollusk be thus associated in popular nomenclature in remote regions? It is interesting to observe that the form possessing commercial value in each instance gives its name to the one which is in lower esteem. G. BROWN GOODE.

The sun's radiation and geological climate.

In my objecting (SCIENCE, p. 395) to the assumption that the dissipation of solar energy from loss of heat diminishes the supply of sun-heat received by the earth, I said, that, so far as there has been any change in the supply, it has been in the direction of an increase, and hence cannot explain the undoubted decrease in the temperature of the earth's atmosphere. I think Professor Le Conte's criticism (SCIENCE, p. 543), taken in its entirety, corroborates my position. He shows that the quantity of heat incident normally on a unit of surface in a unit of time varies as the area of a great circle of the sun × heat-emitting power of each physical point of the sun: hence the quantity emitted would not increase, unless the heat-emitting power increased faster than the square of the temperature. He adds that "some physicists (Rossetti) make the latter proportional to the square of the absolute temperature, while others (Stephan) make it as high as the fourth power." If Rossetti is right, there has been no decrease in the amount of solar heat received; while, if Stephan is right, there has been a very great increase: for, on the assumption that the temperature is inversely as the radius, as stated in Professor Newcomb's article (Popular astronomy, p. 508), the heat-emitting power, if the solar radius is reduced to one-half, will be increased four times, and will just compensate for the great circle being reduced four times in area. If the emissive power increases, as Stephan claims, then a doubled temperature will increase it sixteen times, and, the area being diminished only to one-fourth, the earth will receive quadruple the heat.

It is true that the heat-emitting power of any (solid) body varies according to the area of its surface, providing all the other conditions are unchanged. In case of solids and liquids, very little change can be made in their density by any force that we can apply, — so little, indeed, that no appreciable effect can be produced; but gases are easily affected, and there is no difficulty in conceiving them reduced many times in bulk. Now, suppose two spheres, e.g., of hydrogen, of equal masses and of the same temperature, but one having twice the radius of the other. They will radiate equal amounts in equal times, as I shall try to show. I assume that the radiation goes on only from points of matter, — the atoms of the hydrogen. Conceive each sphere made up of a vast number of concentric layers, each one molecule thick. The number of layers will be the same, and the number of molecules in each will also be the same: consequently the heat-emission of the outside layer will be the same in both spheres. What would be true of the first layer would be true of all, unless the outer one intercepts some of the rays. So far as the outer layer is gaseous and elementary (it is very doubtful whether any chemical compounds can exist in the intense heat of the sun), it is a vacuum to radiant heat; for Professor Tyndall, in 'Heat considered as a mode of motion,' has shown (p. 362) this in reference to oxygen, hydrogen, nitrogen, and air, and, in general (see rest of the lecture), that elementary gases or vapors produce little or no effect upon the radiant heat that passes through them. It must be remembered, too, that the source of heat employed in his experiments was icy-cold in comparison with the sun, and that the penetrating power of heat-rays increases as the temperature of their source rises. It is therefore probable that the heat from the lower layers passes through the upper ones, so far as they are gaseous, with little or no loss, and hence that in gaseous bodies the heat-emitting power for any given temperature is proportional, not to the surface, but to the mass or density.

But suppose that diffused through the upper layers were molecules that were capable of stopping every ray that impinged upon them. Neither the absolute number nor the size of these bodies would be affected by shortening the radius, but only the space between them. If the radius were reduced to one-half, the apertures would be reduced in area to one-fourth, while the radiating molecules within any given distance would be increased eightfold: in other words, the chances of not passing out into space would be increased only four times, while the number of shots would be increased eight times; so that, in this case, the heat-emissive power would be actually increased by the condensation. If to this be added an increase of the same power from the rise of temperature (either as the square or the fourth power, *Rosetti* or *Stephan*), there can, I think, be no doubt that any change which has occurred in the earth's temperature from the sun's losing energy has not been in the direction of growing cooler.

As a corollary of the above, I add, the radiant or heat-emitting power of a sphere of gas appears to be a function of mass and temperature, and not of surface and temperature.

This is of interest in the study of cosmic development.

C. B. WARRING.

Poughkeepsie, N.Y., June 16, 1883.

Flight of the flying-fish.

The difficulties in the way of accurate observation of the flying-fish in motion are numerous and real. Seen always from above, usually at a distance which is constantly increasing, and while the observer himself is in rapid motion, it is not strange that such conflicting opinions exist, or that the mode of flight is so often spoken of as a mystery.

During a trip by steamer from New York to Rio Janeiro *viâ* the West Indies and Pará, and on the return trip coming directly from Rio to New York, I watched flying-fish nearly every day, and frequently all day, and satisfied myself on the following points: —

The fish usually leaps clear of the water at once, leaving it commonly at an angle of 45° or less. After leaving the water, no forward impulse whatever is received (except sometimes from the wind) until the water is again touched, when the tail may be used effectively without immersion of the rest of the body. Very soon after leaving the water, yet not instantly, the pectorals are spread, and an instant later the ventrals.

Both sets of fins are kept *quietly* extended so far as any *voluntary* vibration is concerned. Any similar, tensely stretched membrane would quiver more or less when cutting the air at such speed.

Ordinarily the two pectorals lie in about the same plane. They are never carried much below the body, but are frequently lifted considerably above it, especially when going before the wind, at which time the whole fish rolls from side to side, precisely as does a sailing-vessel under similar circumstances. The course may be a simple curve, as it commonly is in calm weather, or it may be undulating, as is usually the case in rough weather or over a heavy swell. I think the ventrals are used to direct the fish up or down, as they certainly work independently of the pectorals, and closing them would naturally drop the tail. Toward the close of the first stretch, and when the fish wishes to re-enter the water, the pectorals are instantly closed, and he shoots head foremost into the water with only a slight splash.

If, on the contrary, he wishes to continue in the air, the long lower lobe of the tail is allowed to drop into the water, and a few vigorous strokes send him upward and forward, sometimes enabling him to clear another hundred feet before repeating the action, which I have seen him do at least seven or eight times before finally entering the water for a fresh start.

Not unfrequently the tail is dropped, seemingly by closing the ventrals, and an undulating motion so obtained, even when there are no waves or swells to be cleared; and, although the tail may not then touch the surface, it looks as if the fish were *feeling* for the water, which I think is really the case. The poetic wetting of the wings in the crest of a wave so as to prolong the flight appears to be a harmless bit of imagination for all but the fish: to him it is disastrous. His tail alone needs wetting; and, when by mistake he takes the top of a wave bodily, it usually topples him over, or at least checks him noticeably. The drying of the wings would be rather favorable than otherwise.

I was not able to detect any voluntary change of direction to right or left while in the air.

Once a large fish rose quite close to us, and started directly toward the steamer. When within a few yards, he suddenly closed his pectorals, plunged into the water, and almost instantly issued again in a nearly opposite direction.

Examination of a Pacific species in alcohol (and I presume the same general structure holds good for the genus) shows that the pectorals are inserted at such an angle with the axis of the body, that, if the body be horizontal and in motion, the air striking on their lower surfaces must tend to raise the fish, although at the expense of a certain amount of forward motion. Evidently, then, any beating of the pectorals would only retard the fish still more, even if it did support him somewhat in the air. The conclusion seems inevitable, however, that the tail alone is the propeller, the other fins acting solely and passively as supporters.

WALTER B. BARROWS.

Wesleyan university, Middletown, Conn.

HEITZMANN'S MICROSCOPICAL MORPHOLOGY.

Microscopical morphology of the animal body in health and disease. By C. HEITZMANN, M.D. New York, *J. H. Vail & Co.*, 1883. 19+849 p. 8°.

DR. HEITZMANN, formerly of Vienna, now of New York, is well known as an unusually good histological draughtsman. Ten years ago he published some investigations on the minute structure of protoplasm. To his own researches on this subject he has long attributed an importance which scientific men of much greater experience and ability have failed to recognize. The present volume, a very well made and beautifully illustrated book, although it comes in the guise of a manual of normal and pathological histology, is obviously intended principally to bring forward the author's own theories, and to insist upon their fundamental character and great value.

The author so openly implies his conviction that he is a neglected grandeur, that he incites the critic to a severity of comment that a tone of modesty more commensurate with the real value of his researches would not have called forth. The general defect of the book is want of judgment on the author's part, and an exaggerated confidence in his own notions. Thus, being unusually skilful with his fingers, he scoffs at microtomes (p. 7), and closes a slurring paragraph upon them with, "The greater the complication, the less is the value of such machines." A man who makes such a statement without any limitation reveals a hopeless lack of comprehension of the indispensable requirements of many branches of histological investigation. The second chapter in the book discusses the general properties of living matter, and contains a number of characteristic loose assertions: for instance, "Life is evidently a peculiar kind of motion of the molecules (plastidules) of living matter, of a relatively short duration" (p. 14). This is

simply a false statement, since the utmost that could be said is, that unknown molecular changes occur in living organisms. There is no basis for saying that life is 'a peculiar kind of motion,' much less that it is evidently so.

The pages from 20 to 142 are essentially an extended exposition of the author's theories in regard to cells and protoplasm, which he groups under the general term of 'the bioplasson doctrine.' He maintains that all protoplasm is a network, that the nucleus is only a part of the network, and that the network of the so-called 'cells' is really continuous, the whole body forming one mesh. The cells are not distinct elements, but only partially differentiated centres of the mesh: he drops the term 'cell' altogether. He very complacently explains that he has revolutionized the generalizations of all histologists before him, but admits that he expects recognition only from the future. "The present generation of histologists will very probably never realize the harm done by the misnomer 'cell,' etc." (p. 57).

Unfortunately, Heitzmann has entirely overlooked the extremely obvious reasons for rejecting his bioplasson doctrine. He mentions (p. 134) the independent cells, which migrate within the body, but merely remarks that their occurrence 'does not alter the general rule.' If he had been acquainted with the work of the last few years by Fleming, His, Hatschek, and many others, upon the development of tissues, he would have known that a great many of them are derived from just such independent cells, forming a natural group, for which the brothers Hertwig have proposed the name 'mesenchyma.' The existence of these tissues alone suffices to overthrow the theory of a continuous protoplasmatic network as the basis of organic structure. Further, he has overlooked that during segmentation of the ovum a complete separation of the cells is effected: hence it is self-evident, that, even if the network of adjacent cells is found to be continuous in later life, such a disposition is secondary, and cannot, therefore, possess the fundamental significance our author has assigned to it.

As the part, so is the whole, with numerous defects from want of judgment or wider knowledge, and blemishes from want of modesty. The largest part of the volume is taken up with accounts of the various tissues and organs and the pathological changes in them. There is little sense of proportion, — eight pages are given to the cornea, but only one-third of a page to all the sense organs; sixty-three pages to the teeth, and barely two to the development of nervous tissue. If he is to be judged by those two pages, we must assume the author to be entirely unacquainted with the literature of his subject, and to have made no accurate original observations. Indeed, throughout the volume the attention bestowed on recent histological literature is so meagre that it impresses us as an intentional and convenient neglect, rather than as the outcome of ignorance and oversight.

The unequal attention given to different topics renders it impossible to regard the volume as a text-book, although it imitates the form of one. It is really a series of special arguments, or, to speak more accurately, of bare assertions, to prove that the bioplasson doctrine is true of certain tissues. This attempt would be excellent in a series of scientific articles which discussed the doctrine by accurately stating careful and exact observations, and judiciously considering the objections. The author, however, ignores even these elementary requirements of logical argument. On the contrary, as is not unusual with persons of narrow views, he is excessively dogmatic. Of a rigorous scientific demonstration there is only pretence.

Besides the main text, there are numerous contributions in fine print by twenty other writers, whose articles nearly all partake of the singularities of the chief portion of the work.

Those descriptions which do not touch upon the bioplasson doctrine, but merely recite the elements of histology, such as they may be found in numerous text-books, are more accurate than the rest. The style of the book is good, clear, and simple. The presentation of the subject-matter is well arranged and natural. Many of the illustrations are excellent, some could hardly be improved, and all are good in point of technical execution. A large proportion are said to represent the bioplasson network in various tissues: of those that are purely diagrammatic, it can only be said that they are pictorial theories; those, however, which are stated to be drawn from the tissues, represent an organization which we cannot admit to be actual, — a number of spherical granules of nearly even size, and at even distances from one another, connected together by threads of uniform diameter. We believe that figs. 10, 32, 66, 114, 120, and others, showing this pattern of globules and linking threads, have their prototype in the author's imagination, which has distorted the actual

appearance of the protoplasmatic network of cells. If these appearances are real, Dr. Heitzmann's best plan of securing recognition for his views would be to send preparations to be examined by histologists of experience in research. The discovery of the reticular character of protoplasm is very interesting, and our author deserves praise for insisting on this point; but we find in his volume little to awaken the expectation that it will earn recognition for the 'bioplasson doctrine;' which, in our opinion, is not shown to deserve serious consideration, although it is possible or even probable that in certain cases a secondary connection is established between the protoplasm of adjacent cells.

It should be added that special consideration of the pathological chapters has been purposely omitted from this notice as inappropriate here.

EUROPEAN ORTHOPTERA.

Prodromus der europäischen Orthoptera. Von C. BBUNNER VON WATTENWYL. Leipzig, *Engelmann*, 1882. 32, 466 p., 11 pl., map. 8°.

THE activity of systematists within the past thirty years has rarely received a more striking proof than in the publication of the volume before us. When H. Fischer published his classic work on European Orthoptera, the number of recognized species on that continent was less than two hundred and fifty. Brunner, one of our leading writers, now places the number at very nearly double the former figure. The increase is particularly marked in the Locustariae, which have nearly trebled.[1] Already, while Fischer's work was passing through the press, Fieber was making discoveries in the little worked region of south-eastern Europe; and, of late years, Bolivar and others have shown how little the Iberian peninsula was known; yet one would scarcely have looked for such striking additions in so old a field as Europe, and among such bulky insects as the Orthoptera.

Meanwhile there has been great activity in the study of Orthoptera of other parts of the world; and it may safely be said, that, if the number of European Orthoptera has doubled, that of the world at large has quadrupled in the same period. This has entailed much revision and remodelling, in the work of which Brunner, Saussure, and the gifted and lamented Stål, have performed the most honorable part, though they may have been outdone in (diluted) quantity by Walker.

[1] Brunner credits Ephippigera with forty-nine species, of which only ten are given by Fischer. The additions are largely from Bolivar's work in Spain.

There was need, then, that some one should crystallize the methods of recent days for a region so abounding in workers as Europe. This Brunner has now attempted.

He disclaims at the outset any attempt at a monograph. Europe, he rightly says, is no natural province, and the Orthoptera, in the sense of the older naturalists as used in his work, no natural order. For the convenience only of the numerous workers in this region upon the somewhat heterogeneous groups which have been classed under Orthoptera, he issues this Prodromus. It is excellent as a systematic review. The groups are clearly and succinctly defined, but the work is mainly of value in a faunal sense. There is no superfluity of language; analytical tables abound; the balance of parts is admirable; every genus is well illustrated; and, as an expression and synthesis of current toxonomic views, it will serve a most useful purpose. But the biology of these insects is entirely and purposely overlooked; and there is yet room for some one, working upon the excellent model of Fischer, but with the light the newer biological studies have given, to produce a work which shall be classical, and far more fruitful than this can be.

MACHINERY AT PARIS, 1878.

Rapports du jury international, groupe VI., classe 54 : Les machines et les appareils de la méchanique générale. Par M. HIRSCH, ingénieur des ponts et chaussées. Paris, *Imprimerie nationale*, 1883. 8°.

M. HIRSCH has collated and edited the notes of the members of the section of the jury of which he was secretary, and compiled a very extensive and detailed report, with the addition of considerable matter original with himself, thus making a valuable work of the official report. The principal classes of exhibits here examined are steam engines and boilers, with their accessories (divided into stationary and locomotive engines and portable machines), hot-air engines, electric and other motors, hydraulic machinery, compressed-air apparatus, machinery of transmission, machinery of transportation, dynamometers, and miscellaneous parts of machinery. There seem to have been no steam-boilers or accessories from the United States except the Hancock inspirator, which is well noticed. The engines of Corliss and Wheelock are studied at length, and apparently with very satisfactory results, the latter taking the *grande médaille*. A large number of engines were exhibited, — copies of the American Corliss engine, which has evidently

become the best standard among European makers.

Among the hot-air engines, that of Rider is given a leading place, and is fully described. It is commended for its simplicity, its quietness in action, its regularity, and its careful design.

Stow's flexible shafting is noticed as one of the characteristic products of American ingenuity. It consists of two oppositely twisted helices of steel wire, the one enclosing the other, and both covered with a flexible sheath. The device is recommended for the transmission of motion around a corner. These American exhibits were all properly commended in the award of premiums by the jury.

Among other important exhibits from European countries were various forms of 'safety-boilers;' the singular modification of the injector of Giffard, which, by means of the energy of the exhaust-steam, performs the functions of the air-pump in the steam-engine; several forms of compound engine; Hall's pulsometer, which is a modification of the Savery steam-engine of nearly two hundred years ago, with automatically working valves, — an American invention; the gas-engine of Otto, which is said to have exceptional efficiency; the Sagebien vertical water-wheel, which is claimed to have extraordinary performance; the indicator of Deprez, which gives a diagram from the fastest engines; and many other important inventions.

One remarkable feature of the exhibition was the absence of valueless and eccentric devices. This point of difference, in contrasting the exhibition with those which preceded it, is attributed largely to the progress of technical education.

In studying progress, it is noted that the gain is considerable in every direction. In the production of steam, the more general use of 'heaters' of the feed-water is observable, the use of tubular and of the 'safety' forms of boiler is increasing, superheating is oftener practised, better material and workmanship are seen. In steam-engine practice, the use of higher steam, of greater expansion, the adoption of two types exclusively, — the compound of the Wolff type, and the American forms of single-cylinder engines, — greater speed of piston and of rotation, and the use of better material and superior workmanship, are the characteristics of recent practice. Rotary engines are given up. Air and gas engines are extensively used, but only for small powers. Among the hydraulic motors, the turbines are principally used, and have attained great perfection in practice as in theory. Aerostation has made no great progress, notwithstanding the interest which it continually awakens.

American exhibiters distinguished themselves by the boldness and the ingenuity of their designs, and by their entire independence of tradition. Their devices are adapted precisely and effectively to their work. "*Les Américains s'attachaient avec énergie à l'idée première, à l'idée juste; ils l'amélioraient, la perfectionnaient, et, même au prix de grandes complications de méchanisme, ils finissaient par la faire triompher, et par l'imposer de nouveau à l'Europe.*"

MINOR BOOK NOTICES.

Conversion-tables of metric and British or United States weights and measures, with an introduction. By Robert H. Thurston, A.M., C.E. New York, *John Wiley & Sons*, 1883. 83 p. 8°.

In the introduction, the requirements of any system of weights and measures are given. There is a brief history of the English and French systems, and the supposed advantages of the metric are stated. The difficulties and annoyances arising during the change from the English yard and pound to the metre and gram are suggested as sufficient reason for this book. In the second part, containing the tables of conversion, the units of length, mass, stress, work, and heat, temperature and barometric pressure are defined. A chapter is devoted to C. G. S. units. The tables are full, numerous, and seem to be well arranged, and will, without doubt, be found useful by those having occasion to make measurements. This book forms part of a treatise, in three volumes, on the Materials of engineering, by the same author.

How the great prevailing winds and ocean-currents are produced, and how they affect the temperature and dimensity of lands and seas. By C. A. M. Taber. Boston, *Williams*, 1882. 82 p. 12°.

This pamphlet, by Capt. Taber of Wakefield, Mass., gives a practical seaman's views on the origin of winds and ocean-currents, and suggests certain very hypothetical causes for glacial climate. The fundamental errors of the work lie in a misconception of the sun's action in producing, and the earth's effect in deflecting, the winds, and in a tendency to refer apparently simple effects to single instead of composite causes. The other side of some of the questions here raised is presented in Tchiatcheff's or Rolland's descriptions of the Sahara, and Woeikoff's and Hann's articles on the general atmospheric circulation.

The physiology of protoplasmic motion. By Th. W. ENGELMANN. Translated by C. S. DOLLEY. Rochester, N.Y., *Davis & Leyden, n.d.* 40 p. 8°.

This pamphlet, without date or any statement as to the original, is a good translation, with very poor reproductions of the illustrations, of Engelmann's chapter in Hermann's well-known Handbuch der physiologie. It is to be regretted that the author did not see fit to date his translation, nor give the source of the original. The latter omission we are fortunately able to supply.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Orthogonal transformations. — Mr. W. J. C. Sharp has investigated the invariants of a certain orthogonal transformation with special reference to the theory of the strains and stresses of an elastic solid. If a, b, c, f, g, h, are transformed according to the same law as $x^2, y^2, z^2, yz, zx, xy$ (x, y, z, being the rectangular Cartesian co-ordinates of a point, transformed without change of origin), they will have a system of invariants entirely unaffected by the transformation. The author gives the three invariants corresponding to these quantities, and makes a large number of exceedingly interesting applications to different geometrical and physical problems. As Mr. Sharp's paper consists almost entirely of algebraical work, it is impossible to give it more than this brief reference, and to commend it to the notice of those interested in the subjects which he touches upon. — (*Proc. Lond. math. soc.*, xiii.) T. C. [1137

Elliptic functions. — The Rev. M. M. U. Wilkinson has given a number of general formulae arising from the differentiation of the elliptic functions with respect to the modulus. — (*Proc. Lond. math. soc.*, xiii.) T. C. [1138

Unicursal twisted quartics. — Mr. R. A. Roberts considers in this paper some properties of the unicursal twisted quartic curve; namely, the intersection of a quadric and a cubic which contains two non-intersecting generators of the quadric. Almost exclusive use is made of the expressions for the co-ordinates of a point on the curve in terms of one independent parameter. A reduction is first given to the canonical form, and, after examining a particular property of the curve, the author obtains the condition that four points of the curve shall be complanar; then certain points on the curve are examined, and invariant conditions are obtained for degenerate forms of the curve. The next five sections treat of polygons circumscribed about the curve, and the five concluding sections treat of circular unicursal quartics. — (*Proc. Lond. math. soc.*, xiv.) T. C. [1139

PHYSICS.

Acoustics.

Maintained vibrations. — Lord Rayleigh discusses mathematically that type of maintained vibration which is most familiar in the form of Melde's experiment in which a fine string is kept in transverse vibration by connecting it at one end with one prong of a vibrating tuning-fork, the direction of the motion of the point of attachment being parallel to the length of the string. The string settles into a state of permanent vibration whose period is double that of the point of attachment. The equations indicate that an absolutely rigorous adjustment of pitch is necessary, a conclusion not borne out by experiment. This is accounted for by the slight variation of rate with variation of amplitude. The *son rauque* of Savart is probably caused in a similar way, as the periodic variations of tension accompanying longitudinal vibrations will produce associated transverse vibrations. For lecture illustration, a soft-iron pendulum vibrating on knife-edges may be placed vertically over a vertical bar electro-magnet, through which are sent intermittent currents whose frequency is twice that of the pendulum vibrations. Of the same nature are the crispations observed by Faraday on the surface of water which oscillates vertically. The author has shown that Faraday was correct in his opinion that there are two vibrations of the support for each vibration of the liquid. — (*Phil. mag.*, April.) C. R. C. [1140

Hydrogen-whistles. — Le Conte calls attention to an error in Galton's calculations, as he assumes that the number of vibrations of the whistle, when blown with different gases, is in proportion to the density, while it is actually in proportion to the square root of the density. Hence 86,533 instead of 312,000 vibrations would be given by Mr. Galton's proposed whistle. — (*Nature*, May 17.) C. R. C. [1141

Electricity.

Winding electro-magnets. — Professors Perry and Ayrton have experimented upon the following types of electro-magnets: —

1. Wires wound equally over the whole length.
2. Wires coned toward each end.
3. Wire wound equally over half the iron bar, leaving the other end bare.
4. Wire wound on one half, but coned towards the end.

It was found that the effect of coning the wire is to produce a strong field very near the pole, but that the force falls off very rapidly as the distance from the pole increases. At considerable distances from the end of the electro-magnet the uniformly coiled magnet, No. 1, produces the most powerful field. At very small distances from the end of the magnet, Nos. 3 and 4 give the strongest effects. They conclude therefrom, that with a definite length of wire, of core, and strength of current, the mode of coiling the wire determines the strength of the magnetic field at different distances from the end of the electro-magnet. — (*Phil. mag.*, June, 397.) J. T. [1142

CHEMISTRY.

(*Analytical.*)

Ammonic hyposulphite as a reagent in qualitative analysis. — A. Orlowsky suggests the use of ammonic hyposulphite instead of hydric sulphide in a qualitative separation of the metals. In a systematic course of analysis which Orlowsky proposes, lead, barium, strontium, and calcium are precipitated

with ammonic sulphate. The filtrate is acidified with hydrochloric acid, heated to boiling, and sodic or ammonic hyposulphite added, avoiding an excess. The precipitate, which contains antimony, arsenic, tin, platinum, mercury, silver, copper, bismuth, cobalt, and nickel, is next treated with ammonic sulphide. On neutralizing with ammonia the filtrate from the precipitate thrown down by the hyposulphite, cadmium, manganese, and zinc are precipitated. In the last filtrate the alkalies, calcium and magnesium, must be looked for, as well as antimony and tin, since the last two metals are not precipitated completely by ammonic hyposulphite. — (*Journ. russ. phys. chem. gesellsch.*, 1883, 32; *Berichte deutsch. chem. gesellsch.*, xvi. 807.) C. F. M. [1143

Separation of nickel from cobalt. — For the detection of a small quantity of nickel in presence of much cobalt, or of a trace of cobalt with nickel in large quantity, G. Vortman converts the cobalt into the luteo-salt by oxidation with sodic hyposulphite in an ammoniacal solution. Nickel may be precipitated from this solution by sodic hydrate, and, in the filtrate, cobalt by ammonic sulphide. — (*Monats. chemie*, 4, 1, *Berichte deutsch. chem. gesellsch.*, xvi. 810.) C. F. M. [1144

Determination of zinc as sulphide. — In igniting zinc sulphide, R. Macarthur suspends the crucible containing the sulphide in a Hessian crucible with a hole drilled through the bottom large enough to admit the flame of a Bunsen burner. Another hole is drilled through the side of the crucible, through which is passed a glass tube for introducing a stream of hydric sulphide. — (*Chem. news*, xliv. 159.) C. F. M. [1145

METALLURGY.

Copper-smelting plant. — The Pacific copper-smelter has a peculiar arrangement of the water-jacket. By means of circulating plates, a rapid circulation of the water is secured, and also great economy in the use of water. The thirty-ton smelter requires about twenty-five thousand gallons of water per day, if allowed to run to waste; if collected and cooled for use again, only about three thousand gallons are needed. — (*Min. sc. press*, April 28.) R. H. R. [1146

The dephosphorization of pig iron. — The following is the process for which a patent was granted, May 22, to Mr. James Henderson of Bellefonte, Penn. The iron is taken from the Bessemer converter at the end of what is called the third period, or after the boil, transferred by means of a ladle to the hearth of a reverberatory furnace, which is capable of being heated to the melting-point of wrought iron or higher. The metal is treated in this furnace with fluorspar and titaniferous iron in the proportion of forty parts by weight of fluorspar to one hundred of titaniferous iron. If there is one per cent of phosphorus in the metal, about three hundredweight of the mixture will be required to a ton of steel. Thus the dephosphorization is effected after the decarbonization. — (*Eng. min. journ.*, May 26.) R. H. R. [1147

The basic process at Steeltown. — The first heat of basic steel ever made in this country was effected on May 7, 1883, at Steeltown, by the Pennsylvania steel company. The excellent quality of the steel thus made is shown by the following tests. Some flat bars were plunged in water when hot, and then bent cold and hammered down without showing any fracture. A plate was also flanged hot, on which the flange is as perfect as if the material had been the best charcoal-hammered plate iron. In the same plate two holes were punched within a sixteenth of an inch of each other without cracking the intervening steel. — (*Bull. Amer. iron steel assoc.*, May.) R. H. R. [1148

Blast-furnace slag. — It is now proposed by Mr. A. D. Elbers of Hoboken, N.J., to utilize the well-known mineral wool for the manufacture of china cement, pigments and absorbents. The process consists in roasting and subsequent washing of the fine mineral wool so as to leave only the silicates of lime, alumina, and magnesia. — (*Eng. min. journ.*, May 26.) R. H. R. [1149

The Siemens direct process. — A lot of separated magnetic iron sand from Moisic, Canada, was sent to Mr. James Davis, manager of the New steel-works, London, to be worked in the Siemens direct rotatory furnace. Mr. Davis reports that it is the best material for working in the rotator that he has seen. A charge of twenty-five hundredweight with six hundredweight of coal or charcoal gave the best results. The average time required was three hours forty-five minutes, and the yield of solid metallic balls was fifteen hundredweight three quarters. The balls were found very suitable for making mild steel in the Siemens furnace. The wages are estimated at five shillings per ton of balls; the fuel, at ton per ton. — (*Eng. min. journ.*, May 5.) R. H. R. [1150

GEOLOGY.

Geology of the province of Jujuy, Argentine Confederation. — Brackebusch divides the formations of this province as follows. 1°. Sedimentary rocks: *a.* Silurian, *b.* cretaceous, *c.* post tertiary, *d.* modern. 2°. Eruptive rocks: *a.* granite, *b.* quartz prophyry, *c.* diorite, *d.* basalt, *e.* tragnite and andesite. The Silurian consists of two members, — the primordial (Taconic) fauna, being represented in a great thickness of beds, and the second or lower Silurian fauna.

The petroleum-bearing formation has been assigned to almost every geological period. The present author considers it as probably lower cretaceous, and makes a fair argument in support of his claim. Darwin considered it as cretaceo-Jurassic. These beds have an enormous distribution in South America. The same beds are said to reach to Puntas Arenas, where Dr. G. Steinmann (Science, p. 156) has lately recognized the neocomian, which would seem to support the view that they are of lower cretaceous age. Brackebusch thinks that the boring of wells for petroleum in the region he has examined will be attended with magnificent results.

In the quartz porphyries, many ores of copper and argentiferous galenite occur. The trachytes and andesites, and their accompanying tufas, are very widely distributed. To these the author refers numerous gold and silver mines of the province. — (*Anal. soc. cient. argent.*, 1883.) J. B. M. [1151

Lithology.

Fossil-bearing schists. — Renard has published a valuable paper on the metamorphic rocks of the Ardennes, in which fossils had been found by Dumont and Sandberger, the latter describing a case in which garnets and fossils were together in the same hand specimen.

The fossils Spirifer macropterus and Chonetes sarcinulatus show that the schists belong to the lower Devonian. The paper gives the results of microscopic and chemical analyses, describing the principal minerals. Renard rejects entirely the view that these schists are chemical precipitates, and holds that they are metamorphosed sediments.

These results are similar to those of Reusch and

Brögger on the schists of Norway. Both found fossils in crystalline marble, in mica schist, and in other rocks of like metamorphic character. The latter even found the remains of Orthis enclosed in dodecahedral garnet. Likewise the Carrara marble of Italy has been shown to overlie and underlie fossiliferous strata. From these observations, there seems to be no doubt that the general belief that schists are metamorphosed sedimentary rocks is substantiated, so far as these regions are concerned; and they afford no aid to the revived and remodelled Wernerian hypothesis that has been made so prominent in this country during recent years. Without objecting to the work of the writers above referred to, attention may be called to the tendency in most observers, when they have proved the origin of a rock, to assume that all associated rocks are the same, leading one class to hold to the eruptive origin of all the rocks seen, and another to their sedimentary origin. In regions of crystalline rocks, both classes of rocks would naturally be expected to occur together, and it would be well if the utmost care should be used to prove the origin of every rock in the district studied. — (*Bull. mus. roy. Belg.*, i.; *Die silur. etagen* 2 *u.* 3; *Silurfoss. og kongl. i Bergensk.*; *Nature*, xxvi. 567, xxvii. 121.) M. E. W. [1152

Carboniferous gneiss and schist. — Some gneisses and schists, which, from the associated plant-remains, are referred to the carboniferous, have been microscopically studied by Foullon. They are associated with the graphite deposits about Kaisereberg in Steiermark. The gneiss is composed of felspar (albite) quartz, muscovite, and chlorite, with a little epidote, biotite, and, in one case, tourmaline. The phyllite gneiss is fine-grained, and composed of quartz, orthoclase (microcline), and tourmaline; while the graphitic schist is also a purely crystalline mass of quartz and chloritoid, excepting some portions in which are found plant-impressions and plates of a micaceous mineral. Zircon and an asbestiform mineral were also seen. — (*Verh. geol. reichsanst.*, Jan., 1883.) M. E. W. [1153

MINERALOGY.

Some results of the alteration of minerals. — The following facts are communicated by F. A. Genth: —

Albite from orthoclase. — This interesting alteration is well exhibited at the gneiss-quarries of upper Avondale, Penn., where flesh-colored orthoclase is found much decomposed, the cavities being filled with albite associated with muscovite.

Anthophyllite from talc. — At Castle Rock, Delaware county, Penn., talc occurs as the result of the alteration of olivine, but in some cases this alteration has proceeded farther. Radiating from a nucleus of talc is a white or grayish mineral, with silky lustre and prismatic cleavage at an obtuse angle, which proved, upon analysis, to be anthophyllite.

Talc pseudomorph after magnetite. — In Hartford county, Md., small octahedrons of scaly talc occur, the scales being parallel to the octahedral faces; and sometimes the crystals contain in the interior a small nucleus of magnetite. The author regards the crystals as pseudomorphs after magnetite, and suggests that a whole bed of steatite twelve to fifteen feet in thickness, occurring at the above-mentioned place, may have resulted from a like change from magnetite. — (*Proc. Amer. phil. soc.*, xx. 392.) S. L. P. [1154

Wulfenite. — It has generally been accepted that the red varieties of wulfenite found at many localities are colored by chromate of lead ($PbCrO_4$), which is isomorphous with the wulfenite $PbMoO_4$. If this is true, lead chromate must be tetragonal in its crystallization, and trimorphic; for the natural variety, crocoite, is monoclinic, and again it is undoubtedly orthorhombic, isomorphous with anglesite ($PbSO_4$). In red crystals from Phoenixville, Penn., J. Lawrence Smith found vanadium and only a trace of chromium, while Wöhler detected vanadium in a variety from Bleiberg in Carinthia. Owing to the dissimilarity between molybdic and vanadic acids, it is not probable that any isomorphism exists between them, while chromate and molybdate of lead, from a chemical stand-point, can well be regarded as isomorphous. To decide as to the true nature of the coloring-matter, P. Groth had various wulfenites examined by F. Jost, with the following results. In a highly colored, yellowish-red variety from Bleiberg, neither chromium nor vanadium could be detected. In the red crystals from Phoenixville, Penn., chromium was found, but no trace of vanadium. The analysis gave

$$PbO(60).+ MoO_3(39.21) + CrO_3(0.38) = 99.59.$$

The green pyromorphite accompanying wulfenite from the latter locality contained no vanadium, but a trace of chromium; while chromium was also found in a yellowish-red pyromorphite from Leadhills, Scotland. Here, certainly, no isomorphism can exist between the chromate and phosphate of lead; and the red color in the latter case must be due either to the mechanical admixture of some chromate or some pigment entirely independent of the chromium. The fact that wulfenites, entirely free from and containing a trace of chromium, occur of a red color, makes it probable that the color is due to some pigment, perhaps of organic origin, while the chromate is present as a mechanical admixture, and in no way related to the red color. — (*Zeitschr. kryst.*, vii. 592.) S. L. P. [1155

METEOROLOGY.

Solar physics. — A recent report on this subject to the British government mentions India as a satisfactory field in which to prosecute investigations of solar radiation, and its connection with terrestrial phenomena; calls attention to the importance of a more satisfactory means of measuring directly the sun's heat, the great obstacles presented in the attempt to measure this heat at sea-level stations, owing to the very great fluctuations in the observed direct heat, even on clear days, due to invisible vapor; and refers to the expedition of Prof. Langley to Mount Whitney, and the permanent establishment of instruments at Leh in India, at an elevation of 11,000 feet, in order to overcome these obstacles if possible. A very useful, detailed catalogue of sun-spot observations, and photographs of the sun, from 1832 to 1877, is given. A discussion of the influence of the state of the sun upon the earth's temperature is entered upon, in which an effort is made to connect the range of temperature at the single station Toronto, Canada, with the sun's spots. The results arrived at seem to show that a maximum temperature range corresponds to a maximum number of spots, and that the Toronto phases of temperature range lag behind similar phases in solar spottedness between one and two days. The first of these conclusions differs from the opinions held by some, and, on taking the mean annual ranges, seems hardly sustained.

The following table gives the mean annual range of temperature from 1841 to 1880, and mean annual cloudiness from 1853 to 1880, at Toronto, Canada. Solar spot numbers are added for comparison.

Mean annual temperature range, } Toronto, Canada.
" " cloudiness, }
with sun-spot numbers.

Year.	Range.	Cloudiness.	Sun-spots.	Year.	Range.	Cloudiness.	Sun-spots.
	°	%			°	%	
1841	16.8	–	37	1861	14.4	.62	77
1842	17.8	–	24	1862	14.4	.63	59
1843	16.7	–	11	1863	14.7	.61	44
1844	17.9	–	15	1864	14.6	.65	47
1845	17.9	–	40	1865	15.4	.61	31
1846	15.8	–	62	1866	15.0	.61	16
1847	13.9	–	98	1867	15.5	.61	7
1848	14.9	–	124	1868	15.3	.64	37
1849	13.6	–	96	1869	14.6	.66	74
1850	16.7	–	67	1870	15.7	.62	139
1851	13.9	–	65	1871	16.5	.64	111
1852	14.3	–	54	1872	17.6	.59	102
1853	16.9	.57	39	1873	16.9	.60	66
1854	19.8	.59	21	1874	17.4	.63	45
1855	18.2	.60	7	1875	17.4	.62	17
1856	18.3	.57	4	1876	15.7	.66	11
1857	16.4	.60	23	1877	16.2°	.60	12
1858	13.9	.60	55	1878	15.1	.62	3
1859	13.7	.61	94	1879	17.1	.63	6
1860	14.2	.60	96	1880	16.0	.62	–

If these figures be projected in curves, it will be seen that minimum ranges occur markedly about 1848 and 1859, while maximum ranges occur about 1844 and 1855; which are just the epochs of maximum and minimum sun-spot numbers respectively. Making full allowance for varying cloudiness, we still do not obtain any different results. The whole subject needs complete investigation. — (*Rep. com. solar phys. London*, 1882.) H. A. H. [1156

Applications of photography to meteorology. — Photography is constantly finding new applications in the other sciences. By its means, under the direction of Capt. Abney, experiments are being conducted at Kew, Eng., to determine the height and velocity of clouds. Two similar cameras are set up at a distance of about six hundred feet apart, and provided with instantaneous shutters, which can be released at the same instant by electricity. By knowing the angle of inclination of the cameras, and measuring the position of the cloud as photographed on the two plates, we at once have a trigonometrical observation which will give us the distance of the cloud with great accuracy. The axis of a cyclone is probably not vertical, its upper portion being in advance of the lower in relation to the direction in which the cyclone is moving: hence the higher clouds are sometimes affected by an approaching storm before its influence affects the winds blowing at the surface of the earth. The cirrus clouds are, therefore, the ones to whose observation is attached the greatest importance. Occasional observations only have so far been made, but the Meteorological council has under consideration the plan of adopting the instrument for continuous use at its central station at Kew. The observations made so far would seem to indicate that the cirrus clouds are not situated at so great an elevation as has heretofore generally been supposed. — (*Brit. journ. phot.*, May 4.) W. H. P. [1157

PHYSICAL GEOGRAPHY.

Old river-courses by Vicenza and Padua. — F. Molon gives geological and historical evidence to show considerable changes in the rivers Astico and Brenta, on the northern margin of the plain of Lombardy, in post-glacial times. On issuing from the mountains, both of these streams formerly turned westward, toward a depression produced by an old fault running along the eastern margin of the hills from Schio to Vicenza; but, as this district was raised by their deposits, they ran more directly south, and now the Astico is laying its sands on the old beds of the Brenta, while the latter has abandoned the channel which led it through or even west of Padua, and flows farther east. By such diversions from old channels, the volume of some of the lower streams has been greatly affected. The name Retrone was formerly applied to a river of considerable size, extending to Padua ; but it is now limited to a small stream west of Vicenza. The Bacchiglione, an Italian corruption of the German Bachlein, was named when its size justified its meaning; but it has now usurped the place and volume of the old Retrone. — (*Atti ist. veneto*, i. 1882–83, 247, 347.) W. M. D. [1158

Origin of fiords. — Fr. Ratzel calls attention to the broken form of polar coasts in both hemispheres, and the bare, rocky surface of the adjoining lands, and concludes that both of these characteristics result from the strong erosive action of ice. He lays the excavation of not only our Great Lakes and Onega and Ladoga to the same cause, but the Baltic, the North Sea, and Hudson's Bay as well (*Ausland*, 1883, 223, 254). The barrenness of polar lands may well be ascribed to ice-action, which has undoubtedly produced some modification of the surface as well; but to consider all their diversity of form due to glacial erosion exaggerates the power and duration of the ice as greatly as it neglects other and efficient causes. — W. M. D. [1159

GEOGRAPHY.

(*Arctic.*)

Northern voyages in the fourteenth century. — Baron Nordenskiöld has begun the publication, under the title of '*Studier och forskningar*,' of a popular scientific account of early voyages to the high north, as a sort of supplement to the 'Voyage of the Vega,' in which so many early northeastward voyages were noticed. The first volume contains an account and discussion of the voyages of the brothers Antonio and Nicolo Zeno of Venice, who are supposed to have journeyed to the Faeroe Islands, Iceland, and East Greenland toward the close of the fourteenth century. The author brings forward reasons for believing that the voyages were actually made, and the narrative authentic, a general disbelief in them having been (with a few individual exceptions) hitherto prevalent. The volume contains a photographic reproduction of the map of Claudius Clavus in 1427, — a remarkable discovery by Nordenskiöld himself, who found it in the city library of Nancy, included in an old manuscript copy of Ptolemy's Cosmographia. The period when all early voyages were regarded with suspicion or open disbelief seems to have passed away, and the truthfulness of some of them is established; while the misapplication of others (as the Chinese voyages to Fu-sang, now known to be a province of Japan, but formerly interpreted by enthusiastic geographers as north-west America) has been rectified. The danger of running into the opposite extreme of credulity is not, however, to be overlooked, in view of the attention which the perfectly preposterous story of 'Moncatch-Apé' has recently received from a few serious students. It is not necessary to say to any ethnologist who understands the nature of the races of north-west America as they were when discovered, that the story referred to is not less improbable than the wildest vagaries of Jules Verne. — W. H. D. [1160

Nordenskiöld's programme. — Baron Nordenskiöld's programme for this year's expedition is published in full by the concurrence of Mr. Oscar Dickson, who provides the funds to carry it out. Besides the object of penetrating to the interior of Greenland, it is hoped to fix the limits of the drift-ice between Iceland and Greenland, to sound and dredge in the adjacent seas, to pay especial attention to the flora of the ice and snow, to further investigate the plant-remains in the fossiliferous strata of the region visited, and to collect new data connected with the fall of cosmic dust. The expedition sailed from Gothenburg in the latter part of May, and expects to start on its return in September next. — (*Nature*, May 10.) W. H. D. [1161

(*Asia.*)

Corea. — J. C. Hall, British consul at Nagasaki, visited Han-yang or Söul (Seul), the capital of Corea, last October. In approaching the harbor of Nam-yang, the west coast was found hedged in by a thickly clustered fringe of islands, through which the mainland could hardly be seen. The water was very shallow; and the heavy fall of the tides, averaging thirty feet, makes dangerous currents. Thousands of square miles of mud flats are left bare at low water; and, besides all these difficulties, there are the dense fogs of summer, and shore ice of winter. The coast is bold, rising in trap and granite headlands two to six hundred feet high. The interior, as far as seen, was bare and almost treeless. The villages are of miserable mud-hovels, and the people are very poor. The only temples seen were two small huts near a village at the landing-place. Söul is about fifty miles inland; it is a shabby, squalid city of low stone and mud houses, with a population of about 240,000. One long main street one hundred feet wide, running east and west, and another about north and south, divide it into nearly equal portions, and lead to gates in the eastern, southern, and western walls. On the northern side it is enclosed by steep granitic peaks. Below their abrupt slope is the royal enclosure, containing the king's palace and the more important public buildings. Mr. Hall learned from the Japanese consul that the population of the kingdom, according to the government census, was about 6,840,000 souls. The revenue is derived from a tax on the cultivated land, and is payable either in money or in produce: at present it amounts to about 190,000 pounds sterling. — (*Proc. roy. geogr. soc.*, v. 1883, 274.) W. M. D. [1162

Upper Siam. — Between Nov. 9, 1881, and June 14, 1882, Carl Bock, whose travels in Borneo are already well known, made a journey from Bangkok up the valley of the Menam, and across the Lao states to the Mekong River, and back again by much the same route. The country was found very productive throughout, and well worthy of extended commercial enterprises. As far as Rahang, the river was ascended by poling: the country on either side was low, flat, and fertile; numerous ruins were seen there. A variety of valuable timber is brought from the forests by elephants and oxen, and floated down the river to Bangkok. Other products are cotton, wax, resin, tobacco, hides, and horns. Above Rahang, rapids interrupt the up-stream navigation, and the journey was continued overland on elephants. Lakon is the centre of the elephant trade: Bock found a thousand of these great animals there, where they are brought after capture in the forest; their value varies from five hundred to two thousand rupees. Oxen are sold at sixteen to twenty-five rupees. Tchengmai, at an elevation of seven hundred feet on the Meping (the upper course of the Menang, above the rapids) is an important and busy city, with a population estimated at a hundred thousand. Teakwood and gum-lac are among its chief commodities. A railroad from the southern coast should be constructed as far as this point, as, in addition to what now goes down the river, it would gain a large share of what is carried northward to Yunnan, and out to Canton. From Tchengmai, Bock turned a little north-east, and crossed a pass of twelve hundred feet elevation into the valley of the Mekok, that flows on to the Mekong at an altitude of eight hundred and seventy feet. The latter is a large river in a superb valley, lined with valuable forests; its lower course should be examined to learn if timber could not be floated down to the sea. Bock was unable to do this, and returned to Tchengmai, whence he descended the Meping, running the rapids into the open lower valley. — (*Peterm. mitth.*, 1883, 161.) W. M. D. [1163

BOTANY.

Relative size of diclinous flowers. — Fritz Müller mentions Carica papaya — which is something of a curiosity in having polypetalous pistillate flowers and gamopetalous staminate flowers, which have been divided into two so-called genera — as forming an exception to Sprengel's rule, that, in entomophilous plants with imperfect flowers, the male are more conspicuous than the female; that they may be first visited by insects, which carry their pollen to the pistils. The greater size of the pistillate flowers in this species is explained by their concealed position among the leaves, while the smaller staminate flowers hang out in conspicuous clusters. In this connection it is shown by Hermann Müller that in monoecious species, which attract a sufficiency of insect visitors, it may be an advantage for the fertile flowers to be the larger, as those of a given stock will then be visited first, and fertilized by foreign pollen, before the insects have been to the sterile flowers of the plant in question. On the other hand, in cases where crossing is uncertain, the larger size of the staminate flowers will insure at least close fertilization, and thus be advantageous. — (*Kosmos*, April.) W. T. [1164

The purple-leaved barberry. — Mr. Thomas Meehan referred to the fact that seed of the purple-leaved variety of Berberis vulgaris, collected from plants growing near Philadelphia, reproduced the purple-leaved peculiarity to an extent which it could not do more perfectly if the variety were a true species. In a bed of seedlings containing on an estimate one thousand plants, there were only two reversions to the original green-leaved condition. — (*Acad. nat. sc. Philad. meeting;* May 15.) [1165

Influence of stock and scion. — According to the *Tropical agriculturist*, Mr. Moen has obtained some extraordinary and undesirable results from grafting scions of Cinchona Ledgeriana upon stocks of Red bark. The grafts have been cultivated under glass, and are now four years old. Examination has shown that the bark of the stock is rendered abnormally rich in quinine 'by its contact with the graft;' but the bark of the graft itself is found to contain less quinine than it should, while it has more cinchonine and cinchonidine. Since the amount of the bark of the stock is, of course, very small when compared with that of the vigorously-growing scion which must ultimately form the bulk of the whole, nothing is gained by the grafting. It diminishes, rather, the value of the plant. It is now proposed to try the reverse experiment. It is very probable that subsequent experiments may show that part, at least, of the un-

favorable results may be explained by the fact that only young plants have been studied. — (*Gard. chronicle*, May 26.) G. L. G. [1166

ZOÖLOGY.

(*General physiology and embryology.*)

Spermatogenesis. — J. E. Bloomfield gives a *résumé* of the recent papers by Duval, Hermann, Renson, Sabatier, and von Brunn on this subject, and points out that they confirm the old idea that the spermatozoa are developed in mother-cells, a part of which remains behind. (The general hypothetical bearing of this fact was first brought forward by Minot. Bloomfield, in an article on spermatogenesis, advanced this view again, and apparently still regards it as original with himself.) — (*Quart. journ. micr. sc.*, 1883, 320.) C. S. M. [1167

The coloring-matters of the bile of invertebrates. — C. A. MacMunn communicates to the Royal society the results of a systematic examination of the bile and various extracts of the liver of mollusca and other invertebrates. The universal distribution is proved of a chlorophyll pigment, to which the name of 'enterochlorophyll' is applied. It can be found in the bile of specimens of Helix after a six-months fast, and is much more abundant in the liver of mollusca and echinoderms than in crustacea. The presence of reduced haematin is also demonstrated in the bile of several pulmonate mollusks. The bile of the cray-fish and most pulmonate mollusks contains haemochromogen, generally accompanied by enterochlorophyll, and appears in the latter group to be more concerned in aerial than aquatic respiration. He concludes that the so-called liver of invertebrates is a pigment producing and storing organ in addition to its functions connected with the production of digestive ferments. The presence of haemochomogen is apparently connected rather with the mode of life of the invertebrates in which it occurs than distributed according to morphological considerations. A drawing of the microscopical structure of the liver of Limax, showing the enterochlorophyll within the liver-cells, and maps of the most important absorption spectra, described with readings reduced to wave-lengths, accompany the paper. — (*Nature*, May 10.) W. H. D. [1168

Protozoa.

Polemical about protozoa. — In reply to the criticism of Bütschli (ante, **273**) concerning the view maintained by Balbiani in regard to the conjugation of Infusoria, the latter points out that he accepts and has in part confirmed Bütschli's observations, but differs from him as to the conclusions to be drawn from them. From Balbiani's own statement, however, it appears that he has entirely changed his former theories, and essentially adopted Bütschli's; and in stating that his old views could still be essentially preserved he seems not ingenuous. — (*Zool. anz.*, vi. 192.)

Künstler also replies to Bütschli's assertion (ante, **269**) that Künckelia gyrans is a Cercaria: it has no ventral sucker, it swims with the tail forward, and shows no trace of cellular organization. K., however, now admits that it is probably a metazoon larva, and not related to the Flagellata. — (*Zool anz.*, vi. 168.) C. S. M. [1169

Dimorphism of Foraminifera. — It is stated by Munier-Chalmas and Schlumberger that in many genera of Miliolidae there are two forms of the species. Although the individuals are often alike externally, they may be divided into two sets, according to the arrangement of the central chambers. Thus in Biloculina depressa, in form *A* the central round chamber is large, and the other chambers next it follow the bilocular arrangement; in form *B*, the central round chamber is very small, and those next it present the quinquelocular order, which, however, is soon suddenly replaced by the usual bilocular arrangement. This dimorphism is probably general in the group. The authors' first note on this subject is contained in the *Bull. soc. géol. France* (3), viii. 300; their second, in the *Comptes rendus*, March 26, 1883. — (*Ann. mag. nat. hist.*, ii. 336.) C. S. M. [1170

Coelenterates.

Phylogeny of the Siphonophorae. — Fewkes points out the resemblance between the *primitive scale* of Agalma and the *nectocalyx* of Monophyes, as well as the close resemblance of the embryonic knobs of Agalma and Halistemma to the tentacular knobs of the Calycophores.

He believes that these resemblances are an indication of the point in the development of the Siphonophora where the separation of the Physophorae from the Calycophorae, or the separation of both groups from a *stem form*, took place. — (*Amer. nat.*, June.) W. K. B. [1171

New Brazilian medusa. — In his work on the deep-sea Medusae collected by the Challenger expedition, Haeckel describes an interesting genus, Drymoneura, represented by a single species from Gibraltar. Fr. Müller records the occurrence of a second species, Drymoneura Gorge, which he has found in 1857, 1860, and 1861, on the coast of Brazil. The Brazilian form was found in a very shallow inlet, and the genus cannot be regarded as a deep-sea form. — (*Zool. anz.*, no. 137.) W. K. B. [1172

Insects.

Odonata of the Philippines. — Baron de Sélys gives a list of seventy-seven species, with descriptions of new species, and notes on those previously known. Twenty years ago hardly one was known from the region. The present paper is due to the collections of Semper; and, with the exception of Hypocnemus, which is figured, all the genera and even sub-genera are represented in other oriental countries. But forty-one of the species are peculiar to the Philippines. A single species of the otherwise wholly African genus Libellago occurs. — (*Anal. soc. esp. hist. nat.*, xi.) [1173

Scolopendrella. — In a new species described and figured from Massachusetts, peculiar for the robustness of the legs, Scudder finds the openings considered by Ryder as stigmata next the bases of the legs, but believes he has also found stigmata in the head, as in some Thysanura. He also compares the conical protrusion of the mouth-parts to those of Podura. — (*Proc. Bost. soc. nat. hist.*, xxii. 64.) [1174

Growth of the ova in Chironomus. — Jaworowski advances some singular notions on this subject. The eggs grow directly from the blood, not at the expense of other cells, or by the intermediation of the follicular epithelium. In pupal life the amount of the blood is reduced to a minimum; when the eggs are discharged by the imago, they leave a large space; the blood flows in and partly fills it, so that there is less blood left in circulation than can sustain life; hence the insect dies. (It does not appear that the author's startling assertions rest upon any observed facts.) — (*Zool. anz*, vi. 211.) C. S. M. [1175

VERTEBRATES.

Development of the pulmonary epithelium. — The lungs of the human adult have been minutely studied by Kölliker, whose memoir, which appeared in 1881, still left the development of the lung to be worked out. This gap has now been partially filled by Nicolai Jalan de la Croix, who, however, has relied on the chick and mammalian embryos for the earliest stages. In a human embryo of the third month (6.5 cm.) the bronchi are nearly straight tubes branching at acute angles; the alveoli have begun to form at their ends, but are developed in the inner part of the lung only later; the connective tissue is in process of differentiation; the whole system of respiratory cavities is lined by a continuous epithelium, which is thickest in the trachea, where it has several layers of cells, and which gradually thins out, until, in the alveoli, it consists only of two layers of cells, the deeper cells being somewhat smaller, the upper ones irregular in shape, and approaching the cylindrical form. The alveoli are already grouped into lobules; and it is these which Kölliker has described in his embryology as the primitive alveoli. By the end of the fourth month the bronchi branch off at much greater angles; the epithelium in the terminal vesicles is only 15 μ thick, and consists of a single row of cylinder cells. In the fifth month the connective tissue around the bronchi is quite advanced in development; it is, between the lobules, largely fibrous; between the alveoli, still rich in cells. The alveoli themselves measure about 0.05 mm. in diameter; their epithelium, only 11 μ in thickness. The blood-vessels have attained an enormous development, but are not yet close to the respiratory surfaces. Comparison of the different stages shows that the alveoli gradually increase in number, and at the same time diminish in size (author's *résumé*, *vide* p. 109). The conversion of the many-layered original epithelium into the single layer of the alveoli, the author asserts (apparently without definite reason) to be effected by the passage of the deeper-lying cells into the upper layer. By this process, as well as by the multiplication of the cells, is the rapid expansion of the epithelium to be explained. For the history during the fifth to ninth month, de la Croix collates the previous literature.

In the mature foetus (still-born) alveoli are still forming along the alveolar canals. The epithelium of the canals and all alveoli is still cylindrical, the cells with oval nucleus being about twice as high as broad. The alveoli do not yet extend down into the meshes of the capillary net-work. In a child that lived for seven days the flattening-out of the alveolar epithelium had already made considerable progress (Stieda found that this flattening took place much earlier in sheep embryos). The very rapid development of the pavement out of the cylinder epithelium, the author says, must be necessarily produced by the expansion of the lungs after birth. (There are two objections to this view, — first, it is not shown that the change accompanies an expansion; second, it fails to account for the development of the flat cells during foetal life, as in sheep. *Rep.*) — (*Arch. mikr. anat.*, xxii. 93.) C. S. M. [1176

The nature of inhibition. — Professor T. Lauder Brunton has lately offered a theory of inhibition founded on its analogy to the interference which occurs when waves of light or sound meet in opposite phases. According to his hypothesis, there are, in the cord and brain, successive layers of sensory and motor cells, so arranged that each motor cell is connected, not only with its corresponding sensory cell, through which the afferent impulse causing a simple reflex first passes, but also with other sensory cells higher or lower in the cord. When the afferent nerve leading to a sensory cell is slightly stimulated, a simple reflex occurs through the corresponding motor cell. So when several afferent fibres are gently stimulated, as in tickling the sole of the foot, the impulse from each sensory cell passes to a motor cell, and calls forth a reflex contraction. If the afferent fibre leading to any sensory cell is more strongly stimulated, the impulse on reaching the sensory cell will divide, part going directly to the motor cell, part passing to a neighboring sensory cell and thence indirectly to the motor cell. The consequence is, that the two waves of impulse, having travelled paths of unequal length, meet in opposite phases, and an interference or inhibition results. A firm pressure applied to the sole of the foot arouses no reflex contraction. No place is given in the theory to special inhibitory cells. Any cell may exercise an inhibitory action on the sensory or motor cells with which it is connected. Whether its action on any other cell shall augment or inhibit the activity of the latter, depends on the phase in which the wave of impulse travelling from it meets the wave of impulse that has reached the same cell from another source. In the case of inhibition by the will, the impulse sent down from the brain is supposed to interfere with that originating in the cord from the stimulation of sensory nerves. Besides inhibition by interference, apparent inhibition by the diversion of the stimulus into other than its customary path may occur.

Brunton attempts to explain many of the well-known phenomena of inhibition on this hypothesis. His explanation of the action of drugs — such as atropia, morphia, strychnia — on the theory of interference is particularly weak and unsatisfactory. — (*Nature*, nos. 696–699.) W. H. H. [1177

Man.

Electrotonus of the motor nerves of man. — Since the discovery by Pflüger of the general laws of electrotonic changes in a nerve during the passage of a galvanic current, from investigations made upon the dissected nerves of frogs, numerous attempts have been made to verify his conclusions for the uninjured nerve of man. The general outcome of this work has not been satisfactory, as far as a confirmation of Pflüger's generalizations is concerned. Perhaps the chief cause of the discrepancy amongst the results of different observers has been the neglect to fully appreciate the fact pointed out by Helmholtz, that when the uninjured nerve, in its natural position in the body, is exposed to an electrical current, there exist in the region of each electrode, owing to rapid current diffusion, areas of different electrical density, which must, therefore, be considered as electrodes of opposite signs. Waller and de Watteville have investigated the subject anew upon the motor nerves of man, and obtained results which are in accord with the laws established by Pflüger. Their experiments were made in most cases upon the peroneal nerve, and the contractions of the corresponding muscles were registered by appropriate means upon a smoked drum. They employed three methods of stimulation, — induction currents, constant currents, and mechanical stimuli. The unipolar method was used in all cases, and the polarizing and stimulating currents were combined in one circuit. By this means the points of stimulation and polarization were made co-extensive, and the electrotonic changes in the polar region obtained. In mechanical excitation the same result was reached by using the polarizing electrode itself to give the stimulating blow. The authors have

adopted the theory of a 'mixed polar action for both polarizing and testing currents;' that is, at the electrode applied to the nerve, there exist for each current, stimulating as well as polarizing, a 'polar' region of the same sign as the electrode, and a 'peripolar' region of the opposite sign, the electrical density of the latter being less than that of the former, but still sufficient to act as a physiological stimulus. When an induction current was used to test the 'polar alteration of excitability' produced by the polarizing current, the results were found to differ according as the 'exploring' electrode represented the kathode or anode of both currents, or the kathode of one and the anode of the other. In the first case the effect of the induction shocks are increased; in the second case, diminished. They explain their results in this way. When the electrode is kathode of the induction current, the excitation proceeds from the kathodic polar region. If the electrode is at the same time the kathode of the polarizing current, the polar region is kathodic, and possesses increased irritability. If the electrode is anode of the polarizing current, the polar region is anodic, and its irritability is diminished. When, on the other hand, the electrode is anode of the induction current, the excitation proceeds from the peripolar kathodic region, since all contractions with induction currents are make-contractions. If the electrode is at the same time the anode of the polarizing current, the peripolar region is kathodic, and therefore of increased excitability. If the electrode is kathode of the polarizing current, the peripolar region is anodic, and therefore of diminished excitability. When the testing current is a galvanic current, and both polarizing and testing currents are in the same direction, it is found that the effect of the kathodic make is increased during the flow of a kathodic current, and of an anodic make during the flow of an anodic current. The excitation proceeds from a kathodic region of increased irritability, in one case polar, in the other peripolar. So the effect of a kathodic break is diminished during the flow of a kathodic current, and of an anodic break during the flow of an anodic current. The excitation arises from the disappearance of an electrotonus in an anelectrotonic region of depressed irritability, in one case peripolar, in the other polar. With regard to mechanical stimulation, it was observed that the effect is increased when the polar region is kathodic, and diminished when it is anodic. They made some experiments upon the after-effects of the polarizing current, the results of which show that there is an after-kathodic diminution and an after-anodic increase of excitability, which are more marked in the polar than in the peripolar region. — (*Phil. trans.*, 1882, 961.) W. H. H. [1178

Electrotonus of the sensory nerves of man. — Waller and de Watteville have carried out a series of experiments on the alterations of excitability of the sensory nerves during the passage of a galvanic current, similar to those made upon the motor nerves. Their method of work was essentially the same as in the preceding investigation. In order to measure the increase or diminution of sensation after polarization, they ascertained the least strength of current which would produce a 'reaction in consciousness,' and then noted the changes necessary to be made after polarization to obtain the same effect. Their general result is, that, "after the passage of a galvanic current, the alterations in the excitability of the sensory nerves of man follow a course essentially similar to that observed in the motor nerves." — (*Proc. roy. soc.*, 1882, 222.) W. H. H. [1179

ANTHROPOLOGY.

Smithsonian anthropological papers. — The great delay in bringing out the annual report for 1881 has induced Prof. Baird to publish the scientific summaries and the anthropological papers in separate pamphlets. The summary, as usual, is by Prof. Mason, and the papers were all prepared under his editorial care. The summary is divided into two parts, the discussion and the bibliography. In order to show just where each contribution for the year stands with reference to the whole, he divides anthropology into eleven parts, — anthropogeny, archeology, biology of man, psychology, glossology, ethnology, technology, sociology, mythology, hexiology, and bibliography; the latter term including all aids to the study of man. By the use of the Greek words *γράφη*, *λόγος*, *νόμος*, and *γενεά*, the suffixes -ography, -ology, -onomy, and -ogeny, may be applied to each of the foregoing terms, in order to indicate the observing, the classifying, the discursive, and the philosophic phases of each branch of inquiry. Separate chapters are devoted to each of the leading topics.

The miscellaneous papers are unusually numerous. Explorations of mounds in Kansas are reported by Mr. Serviss; in Iowa, by Banta and Garretson; in Missouri, by Hardy, Scheetz, and Watkins; in Wisconsin and Illinois, by Moody, Shallenberger, and Adams; in Ohio, by Luther; in Kentucky, by Linney and Evans; in Tennessee, by Haite; in Alabama, by Gesner; in Georgia, by Whittlesey; in Florida, by Bell. Other aboriginal works are treated by Whitcomb for Washington Territory, by Stinson for Indiana, and by Case and MacLean for Ohio. Miscellaneous antiquities are reported from Iowa by Dean; from Illinois, by Gale, McClelland, French, Farrell, and Sibley; in Texas, by Roessler; in Arkansas, by Jones; in Pennsylvania, by Hayden; in New York, by Sheward; in Connecticut, by Ellsworth; and in Nova Scotia, by Patterson. Besides these are papers on shell-heaps in Alabama, West Virginia, and Massachusetts, by Mohr, Hubbard, and Wing; on inscriptions in Arkansas, by Green; on buried flints in Illinois, by Snyder; on silver crosses from a Georgia mound, by Jones; on ancient canals in Florida, by Kenworthy; on rock-carvings on the Susquehanna, by Galbraith; on a sculptured stone from New Brunswick, by Jack; on a perforated tablet from New York, by Tooker; a specimen of aboriginal art, by Matthew; and on the aborigines of Florida, by Walker. — J. W. P. [1180

Egyptian boomerangs. — Gen. Pitt-Rivers takes the occasion of receiving an Egyptian boomerang as a text for the review of the subject of the spread of that interesting weapon. His description is accompanied by a plate, giving figures of twelve boomerangs from the same quarter, which he had seen in different museums. There are four phases in the evolution of the boomerang worthy of notice. 1. All weapons which are thrown by the hand, and which are not specially adapted for rotation. 2. A round, curved stick, which would rotate more freely than a straight one. 3. The same weapon made from a split stick, opposing to the atmosphere a thinner edge, whereby the rotation and range would be greatly increased. This is the most important stage in the development of the boomerang. In this state it was used by the Australians for purposes of war, after they had further acquired a knowledge of the returning or screw boomerang. It was in this stage that Gen. Pitt-Rivers supposes it was carried by the black races into those distant regions where it is now used. 4. Those weapons to which is imparted by

peculiar twists a screw movement tending upwards, or at any rate in a direction that is perpendicular to the plane of rotation. This last stage of improvement, so far as we at present know, was effected in Australia only, and not in those countries into which, in its simpler form, it had been previously distributed by the migration of tribes. The Egyptian, African, and Dravidian boomerangs may not have been independent inventions, therefore. The boomerang being a weapon of very primitive construction, and its present distribution being coincident with the distribution of some of the black races of man, it may with great probability be regarded as one of those weapons which primeval men carried with them into distant parts from the home of their ancestors, wherever it was. In speaking of the distribution of this weapon, writers should be careful to note that the Egyptian boomerang, the trombush of the blacks of Abyssinia, and that of the blacks of Hindostan, correspond only to one class of the Australian boomerang, — viz., that used by them for war, and considered to be the most useful weapon they employ, — and that this differs from the returning boomerang, which has a lateral twist by means of which it is caused to rise in the air, screwing itself up precisely in the same manner as a boy's flying-top, which rises and spins against the ceiling. — (*Journ. anthrop. inst.*, xii. 454.) J. W. P. [1181

Hittite inscriptions. — So many attempts to decipher the Maya hieroglyphs have been based upon the processes that have led to brilliant results in Egyptian and Mesopotamian inscriptions, that we are not surprised to find an author deciphering Hittite by means of Aztec phonetic values. Prof. John Campbell of Montreal has in press a volume on the history of the Hittites, their migrations, antiquities, and language, in which will appear translations of some of the inscriptions first discovered by Mr. Drake in 1871. A pamphlet of sixteen pages, however, precedes the volume, giving the translations. Briefly, the author believes that the Hittite empire, overthrown in 717 B.C., was re-established successively in India, north of the Altai, north-east of China, in Khitan, Mantchuria, Saghalin, Corea, and Japan, and finally as Aztec, Peruvian, and Chibcha, on the American continent. Mr. Campbell, therefore, has only to give to the characters of Hamath resembling those of Mexico their Aztec phonetic values, and the thing is done. — J. W. P. [1182

EGYPTOLOGY.

Geography. — The vast field of ancient geography yet to be explored is indicated by the fact that two thousand names of places outside of Egypt, mentioned in the geographical lists, still await identification. Brugsch points out some necessary cautions. 1°. The different systems of orientation. The Egyptian always imagined himself as standing face to the south : the east was on the left hand, the west on the right hand, and the north behind him. The African made a point, between the Nile and the Red Sea, east of Ethiopia, the place from which he judged of the relations of countries : hence to him Ethiopia was in the west, etc. The Asiatic faced the east, and spoke of it as before him, the west as behind him. And the Egyptian monuments represent, sometimes one, sometimes another, of the systems in giving the relations of the same place. 2°. The Egyptians very frequently translated and did not transcribe foreign names. It has often been remarked that the names of nations well known in pre-classic antiquity, and with whom the Egyptians were well acquainted, are not found on the monuments. These names must be sought in the Egyptian translations. 3°. The Egyptian geographical lists, in their enumeration of African peoples, proceed from south to north : among Asiatic nations they proceed from north to south; i.e., in both cases they follow the downward course of the great rivers.

Brugsch believes that Punt was a southern land, not in Arabia (where most place it), but in Africa, and that the Egyptians sent expeditions thither at a very early period in their history. Hommel (*Vorsemitischen kulturen*, 1883, p. 108, 421) thinks these expeditions began about 2450 B.C. — (*Revue egyptol.*, iv.) H. O. [1183

NOTES AND NEWS.

The remains of the late Professor Charles Frederic Hartt, who is well remembered for his extensive scientific researches in Brazil, arrived at New York from Rio de Janeiro on June 7 last, by the steamer Finance. They will be carried to Buffalo, N.Y., the home of Mrs. Hartt, for interment. Over five years have now elapsed since the death of this distinguished naturalist and linguist, whose life was so faithfully dedicated to the cause of Brazilian science. Completely worn out by the drudgery of official cares in trying to perfect the organization of which he was the chief, against the jealousies of a foreign and unappreciative people, he fell an easy victim to that most dreaded of all Brazilian scourges, yellow-fever, which afflicted so many Americans during the early spring of 1878. His grave in the protestant section of one of the larger Rio cemeteries has borne no other mark than the customary number by which it could be identified. While Brazil has neglected the memory of one who more than any other gave character and purity of purpose to its scientific undertakings, his own country will not fail to do him homage.

— The Report of the chief of ordnance, U.S.A., 1882, contains some important matter relating to the science and practice of gunnery. Col. Crispin makes a long and valuable report on European ordnance. The methods of construction of British and French ordnance are described, and the advantages of malleable over cast irons are exhibited. The now familiar effects of tempering in oil, as practised in British gun-making establishments, are described. Soft steels having a tenacity, untempered, of thirty-one tons per square inch are given a strength of forty-seven tons by oil-tempering, their elongation being, meantime, reduced somewhat by the process. The reporting officer concludes that the direction of change is toward the introduction of built-up forged guns, or built guns of cast steel, and that the future is to see the introduction of this principle carried to its limit in guns made of coiled wire, as proposed by Treadwell of Cambridge, and recently by Woodbridge, — a conclusion manifestly at variance with the results described in his report as attained by Whitworth with solid guns of compressed steel. The principles upon which Whitworth is working

are summed up by that inventor as "strong, ductile, and sound materials, strong, quick-burning powder, short guns, long projectiles, and rapid rotation." Lieut. Birnie's conversion-tables for metric measures are included in this volume. They are substantially the same as those issued by the Messrs. Wiley, together with Noble's British tables, and other matter from Thurston's Materials of engineering. Capts. Michaelis and Greer discuss the deviations of projectiles mathematically. The report is supplied to libraries and scientific departments by the chief of ordnance.

— De Candolle's 'Origine des plantes cultivées' has received a searching review at the hands of Professor Asa Gray and Mr. J. Hammond Trumbull in the *American journal of science*. The book itself is as valuable to anthropology as it is to botany, and it was fitting that a competent representative of each of these sciences should be associated in its examination. The reviewers, however, in this case, seem to have had a definite object ulterior to that of merely appreciating this last great contribution of the venerable phytologist. The claims of America as the original source of a large number of the best-known vegetable products of the globe required to be defended; and they deliberately assumed and performed this task, showing in a large number of cases that De Candolle had either ignored or had not duly weighed the evidence that exists in favor of their American origin. The comprehensive and critical learning displayed in these articles, relative to the mention of these plants in the early history of American discovery, is only equalled by the shrewdness and force with which it is marshalled in support of the views which the writers feel called upon to set forth and sustain.

— 'Progress in meteorology, 1879–81.' This useful contribution to the English literature of meteorology has been published by the Smithsonian institution under the editorship of Professor Cleveland Abbe of the army signal-office. It consists, as the author expressly states, of extracts, mostly from the Vienna *Zeitschrift* for the years 1879, 1880, and 1881; and this accounts for the notices from the German of two papers originally published in this country. Biographical notices of eminent meteorologists who died in the interval covered by this pamphlet, a concise description of the work contemplated by the Polar commission, and an account of the meteorological work in hand and proposed by nearly all the different governments, are given. Under well-arranged heads, such as bibliography, methods, apparatus, etc., chemical and physical properties of the atmosphere, solar radiation and terrestrial temperature, movements of the atmosphere, barometric pressure, electricity, magnetism, and optical phenomena, will be found abundant material for study, and of the later scientific investigations in the protean subject of meteorology.

— The Worcester county, Mass., free school of industrial science is now completing its fifteenth year. It offers free instruction to students, who, at the time they enter, are residents of the county. There is a further endowment by the state for twenty free scholarships for students elected by the board of education. The school is by no means a local institution, a large number of the boys coming from outside Massachusetts. At present there is great need of an increase in the accommodations of the chemical and engineering departments. The friends of the institution are bestirring themselves, and have issued a pamphlet stating the results of the school's work up to this time, and the urgent need there is for further room, that the growth of the institution may not be cramped. The mechanical department, possibly the most thriving, has received, within the last two or three years, greatly increased facilities, but is pressed to the utmost to fulfil the demands upon it.

— At the meeting of the Engineers' club of Philadelphia, May 19, Mr. C. G. Darrach exhibited two profiles from Tiffin, O., to Lake Station, on the southern bend of Lake Michigan. The surveys were made for the Baltimore and Ohio short line to Chicago, — one *viâ* Napoleon, and the other *viâ* Defiance, O. About 240 miles of surveys were run, and the profile and maps plotted in sixty working-days, with a party of eight men.

At the meeting of June 2, Mr. Carl Hering read a short article on electrical units and formulae; Prof. L. M. Haupt exhibited a drawing of the Phoenixville bridge, which was built by Mr. Moncure Robinson, C.E., in 1836, for the Philadelphia and Reading Railroad, over the Schuylkill. It is an instructive and enduring monument of successful construction of cut-stone masonry. There are four segmental arches 72 feet clear span, and 16½ feet rise; radius of arch, 47½ feet; voussoirs, 2 feet 9 inches thick. One end abuts against a rocky bluff, whilst the other is supported by a heavy abutment with an earthen filling. It is believed to be one of the lightest and cheapest bridges of its kind in this country, having cost but $48,000. The secretary exhibited samples of Japanese paper, which he had obtained through Mr. J. A. L. Waddell. Many Japanese papers are of excellent quality, and could probably be used with great advantage in engineering practice.

— Van Nostrand has published, as one of the excellent 'Science series,' a book of logarithms to four places, of logarithmic and natural functions. The tables seem to be very well arranged, especially those of the natural functions.

— Dr. Ralph Copeland, editor of *Copernicus*, writes to that journal in the latter part of February last, from La Paz, Bolivia, 12,050 feet above the level of the sea, —

"For the first time for ten days, the sky is tolerably clear, and remarkably dark, although the moon is al-

most exactly full, and at an altitude of some 30°. At 9h. 30m. local mean time, to test the clearness of the air and the visibility of fifth and sixth magnitude stars, I made a naked-eye sketch of the Hyades and Pleiades, which were also roughly at the same altitude as the moon, but considerably more than 90° distant from her. In the Pleiades I distinctly made out ten stars, — D. M. + 24°, 553 and 556, both of 7.0 magnitude, being seen as one star; and D. M. + 24°, 546, of magnitude 6.3, being clearly visible. In the head of Taurus I made out seventeen stars, two of which — D. M. + 16°, 586, and + 16°, 605 (of 6.0 and 5.0 magnitude) — are not in Argelander's *Uranometria nova*. I also saw σ Tauri plainly double.

"As it is now near the close of the rainy season, I hope shortly to be in a position to report something of what can be done with a six-inch refractor at 14,360 feet above the sea-level. My station is at Vincocaya, between Arequipa and Puno. In the mean time I am endeavoring to obtain the height of the Ilimani."

— Dr. Ralph Copeland, editor of *Copernicus*, writes to that journal in the latter part of January last, from Lima, —

"At Chorillos, near this, are staying M. Barnaud, Lieut. de Vaisseau, and M. Favreau, Enseigne de Vaisseau, members of the French Venus expeditions to Chili. Chorillos is the landing-point of the cable from Valparaiso and Panama. The French astronomers, in conjunction with two colleagues now at Valparaiso, are determining the difference of longitude. They have two-inch transit instruments, with chronographs and chronometers; and the cable is led directly into the observatory. The instruments are similar at both stations, and the observers do not interchange stations; but the personal equation has been determined for wire-transits, and signals transmitted by Thomson's galvanometer. The strength of current is adjusted by a rheostat to a constant strength. A triangulation will connect Chorillos, Callao, and Lima, distant some six or seven miles from each other. The connection of Valparaiso with Buenos Aires on the one hand, and with Callao and Panama on the other, will complete the circuit of the greater part of South America; the chain from Greenwich to Buenos Aires, through Lisbon, Madeira, St. Vincent, Pernambuco, Bahia, Rio Janeiro, and Montevideo, having been finished by Lieut.-Commander Green, U.S.N., in 1879."

— The first *livraison* of *Les nouvelles conquêtes de la science*, par Louis Figuier, is devoted to a sketch of the application of electricity to lighting. Judging from the sample of explanation given in the introduction, where the glowing of a conductor is attributed to the accumulation of an electric fluid, it cannot be said that the book promises to give a straightforward statement of facts without embellishment. The illustrations are numerous and attractive. Very much of the same untrustworthy character is the first *livraison* of *Nouvelle histoire des voyages*, par Richard Cortambert. Both of these books are for sale by F. W. Christern, New York.

— Prof. C. S. Sargent has recently prepared a striking statement of the loss, actual and prospective, suffered from forest-fires, and of the necessity of stringent legislation for their prevention. Especially should this loss be brought to public attention in New England, where so much surface is adapted only to forest-growing, and whence a great share of our white pine must come in future years. These states already possess valuable forests of second-growth pine, now reaching a size when they can properly be thinned out, leaving the smaller trees for future need. But in Massachusetts alone, ten thousand acres of forest are on the average burned annually; about one-third of the fires beginning from locomotive sparks, and nearly all the rest from easily avoided carelessness. This burning not only destroys the standing trees; it makes investment of capital in growing forests hazardous, it checks the growth of a very desirable industry, and it destroys the capacity of the ground to continue a pine growth. When properly cut, a pine forest may be propagated indefinitely. When burned, there is a long succession of weeds and briers, mountain cherry, gray birch, willows or poplars, maples, and ash-trees, until a hard-wood growth is established. This maintains itself for a long time if left alone; but if the ground be then cleared by cutting, cultivated for many years, and then left free from plough and scythe, and guarded from pasturing and fire, the white pine will spring up spontaneously after its long absence. Fifty or one hundred years must pass before this desirable crop returns. In view of so long a delay, and of the considerable value that pine will soon command, it is well that special care should be given to protecting and preserving the second-growth forests now approaching maturity.

— The national congress of the French geographic societies will meet this year at Douai, seat of the Geographic union of the north of France, on Aug. 26, for a week's session. Excursions will be made to Calais and other points on the channel, and to Charleville, and across the Ardennes to Belgium. A geographic exhibition is proposed in connection with the meeting.

— M. de Lesseps recently stated to the French geographical society that the work on the Panama canal was going on in good condition. Excavation has been begun all along the line. Two American machines had just been received, capable of digging three to four thousand cubic metres a day. The work is in charge of the chief engineer '*des ponts et chaussées*,' sent out from France by the canal company some months ago. The Algerian canal, in which M. de Lesseps is interested in connection with M. Rondaire, now, he says, stands a good chance of

receiving government concessions, in spite of the adverse report made by the Academy of sciences last year.

— The Entomological society of London, the second of its name, held its fiftieth anniversary last month; and, in his presidential address upon the occasion, Mr. J. W. Dunning suggested that Professor Westwood of Oxford be made titular life-president of the society. "An original member, he has never failed us. During the crucial period of our childhood, he was the motive power, the life and soul, of the society. For fourteen consecutive years he was secretary, and for part of that time he was curator also. The council has seldom been complete without him, and during six years he was our president. Whilst he resided in or near London, he rarely missed one of our meetings. Even Oxford cannot keep him away from us; and there is not a single year, from first to last, that he has not been a contributor to our transactions." This proposal was carried by acclamation.

— The unusual competition for the last 'Walker prize' of the Boston society of natural history induces the society to offer the same subject for next year's competition; viz., 'Original unpublished investigations on the life-history of any animal or plant.' While the partial treatment of the subject is permitted, preference will be given, other things being equal, to memoirs which embrace the whole life-history of an animal or plant from the early embryological stages to the adult form.

The society also offers, through the generosity of a member, for next year, a special first prize of from $60 to $100, and a second prize of $50, on the following subject: "A study of the venation of the hind-wings of Coleoptera, with illustrations of all the families of Le Conte's and Horn's classification." Essays in competition for both prizes must be sent to the secretary of the society before April 1.

— Over four hundred members of the British association have already pledged themselves to attend the meeting at Montreal in August, 1884. It is believed that all the permanent officers of the organization will be present.

— We learn that a series of fifteen original letters of Alexander von Humboldt to his intimate friend Wegener, bearing the dates 1788–90, is for sale in Germany. They have been made use of for the biography of Humboldt by Bruhns; and extracts have been more than once published, — most recently, in the Berlin journal *Gegenwart*, nos. 30 and 32, of 1882, — but they have never appeared in full. Any institution or private person desiring to acquire them should apply to Dr. G. A. Saalfeld, Hobsminden, Germany.

— In the weekly summary ¶ **1075**, line 20, instead of 'acid,' read 'pentachlor- and hexachlor-compounds.'

In the 'Weather in March,' p. 388, for 'Fallstown, Ind.,' read 'Fallstown, Md.'

RECENT BOOKS AND PAMPHLETS.

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ERRATA.

Page 50, col. 2, line 31, for 'Paramarcium' read 'Paramecium.'
" 73, " 1, " 67, for 'photographic sun' read 'photographic gun.'
" 97, " 2, " 16, for 'elevation in Greenland' read 'elevation in the region of greatest cold (the west) in Greenland.'
" 116, " 2, " 35, for 'tennicollis' read 'tenuicollis.'
" 119, " 1, " 16, for '*Chilly*' read '*Cheilly*.'
" 149, " 1, " 54, for 'Rogiferidae' read 'Rangiferidae.'
" 149, " 1, " 54, for 'Copridae' read 'Capridae.'
" 151, " 1, " 42, for 'Reptiles' read 'Mammals.'
" 177, " 1, " 19, for 'Rurichnites' read 'Rusichnites.'
" 177, " 1, " 20, for 'Traena' read 'Fraena.'
" 192, " 1, lines 10, 11, the clause "the coal next the mouth not partaking of the motion of that farther in the hill" belongs to the preceding and not to the succeeding sentence.

Page 255, col. 1, line 2, for 'Mittag-Zeffler' read 'Mittag-Leffler.
" 287, " 1, " 67, for 'tortricid' read 'tineid.'
" 294, " 1, " 8, for 'dollars' read 'shillings.'
" 306, " 1, " 23, for 'Lamium' read 'Lanium.'
" 338, " 2, " 49, for 'Rumford' read 'Ranyard.'
" 388, " 1, " 1, for 'Ind.' read 'Md.'
" 536, " 2, " 6, for 'Lun City' read 'Sun City.'
" 542, " 2, " 63, for 'grypus' read 'gryphus.'
" 550, " 1, " 49, for 'acid' read 'pentachlor- and hexachlor-compounds.'
" 612, " 2, " 34, for 'Drymoneura Gorge' read 'Drymonema gorgo.'

On p. 191, the cut, which is printed bottom upward, should be reversed.